Factory

MANAGEMENT AND MAINTENANCE

Vol. 95, No. 3 — March, 1937

CONTENTS

Strike Aftermath 33
An editorial

What of the Speed-up? 34
Industry cannot count on overworked employees

Labor Laws in Great Britain 36
Timely analysis of British experience

Open House 37
Armco invites the neighbors in

Plymouth Bought 38
Paid for new equipment in 421,120 motors

Rate Setting with Battery Constant 40
Where one man runs several machines

From Pickling to Machining Automatically 41
By trolley; trick is in a transfer

Less Walking, More Working 44
Motion-economized layout saved 30 per cent

Women Are More Adaptable 46
Not wrapped up in one specific job

Truckers and Sweepers on Bonus 47
Eleven men are doing 19 men's work

Jobs Keep Pace 48
Says National Industrial Conference Board

Overhead by Formula 49
Plea for scientific approach

Our Production Planning Begins at the Shipping Door 50
But there's nothing backward about it

You Want to Know 52

To Keep Electronic Devices Operating ... 53
Haphazard tinkering is absolutely out

Lighter, Stronger by Welding 55
Welding progress in a comparatively new field

60 Foot-Candles Mean Real Seeing 56
Oshkosh B'Gosh cuts down number of mistakes

Strip Heaters Keep Fire Pump Motors Dry 58
Insure prompt starting in emergencies

50 Per Cent Less for Power 59
Credit a new distribution system

Half the Steam per Pound of Product 61
American Hard Rubber wages war on waste

Operating Shorts

Cabinet Saves Time and Space 63
How to Measure Static Torque of a Load 63
Tagging Safety to Distribution System 64
Hard-Alloy-Tipped Key Seats Itself 64
Inspection Benches Painted Black 64
Guide Block Pulls Wires into Conduit 64
Heated Patterns Raise Production 10% 65
Heated Oil to Soften Leather Washers 65
Telephone Alarm from Distant Substation 65
Lot-Storage Is Big Help in Assembly 65
The Man Must Fit the Job 65

Valve Installation and Maintenance 67
Data sheet

Line Voltage Drop 68
Data sheet

What's New in Equipment 69

Trade Literature 74

It's This Way in Washington 76

Sayings and Doings 77

Books 102

FACTORY'S PLANT OPERATION LIBRARY

Social Security Records ..... S369-S380 ..... Preceding Back Cover

MASON BRITTON, *Senior Vice-President* L. C. MORROW, *Editor* A. M. STAEHLE, *Manager*
G. A. VAN BRUNT, LEWIS K. URQUHART, *Associate Editors* C. G. SMITH, J. F. ANDREWS, *Assistant Editors*
A. H. MOGENSEN, ARTHUR VAN VLISSINGEN, JR., *Consulting Editors*
H. P. DUTTON, *Chicago* CHARLES B. GORDY, *Detroit* PAUL WOOTON, *Washington*
Factory Management and Maintenance is a consolidation of *Factory and Industrial Management* (including "*Factory*") and *Maintenance Engineering*

Price 35c. a copy. Subscription rates—United States, Canada, Mexico and Central and South American countries, $3 a year. All other countries, $4 a year or 16 shillings. Cable address "McGrawhill, New York." Member of A.B.P. Member A.B.C. Copyright, 1937, by McGraw-Hill Publishing Co., Inc.

Factory Management and Maintenance. March, 1937. Vol. 95; No. 3. Published monthly. McGraw-Hill Publishing Company, Inc. Publication office, 99-129 North Broadway, Albany, N. Y. Editorial and executive offices, 330 West 42d Street, New York, N. Y. Entered as second class matter, November 13, 1936, at Post office, Albany, N. Y., under the Act of March 3, 1879.

JAMES H. MCGRAW, JR. Chairman — MALCOLM MUIR President — JAMES H. MCGRAW Honorary Chairman
MASON BRITTON Senior Vice-President — B. R. PUTNAM Treasurer — D. C. MCGRAW Secretary

Branch Offices: 520 North Michigan Ave., Chicago; 883 Mission St., San Francisco; Aldwych House, Aldwych, London, W. C. 2; Washington; Philadelphia; Cleveland; Detroit; St. Louis; Boston; Atlanta.

A MILLION SPEEDS
at the touch of a finger

TRANSITORQ
TRADE MARK

Transitorq gives more than infinite speed change — more than exactly the speeds required on a job — for among all variable speed devices its EASE OF CONTROL is outstanding. No more than the merest touch of a finger on the control wheel is needed — a light, sensitive action which greatly facilitates the use of remote controls of every type. But with this marvelous ease of operation, Transitorq assures a *positive drive* — and there are no continuous wearing parts to require replacement. . . . New Departure Division General Motors Corporation, Bristol, Connecticut; Detroit, Chicago and San Francisco.

NEW DEPARTURE *Variable Speed* TRANSITORQ

2522-P

Factory
Management and Maintenance
L. C. MORROW • EDITOR

Strike Aftermath

ONLY the future will show whether the Committee for Industrial Organization or General Motors won the recent strike.

The C.I.O. did *not* win the closed shop. It did *not* succeed in permanently eliminating either the craft union group or the employee representation group as bargaining agencies.

But in a noisy, public way the C.I.O. *did* win recognition as the collective bargaining agency for its own membership. It *did* stop General Motors from bargaining—without the consent of the governor of the state—with the other groups for six months in seventeen plants. And it *did* prove that it has the partisan support of both federal and state governments.

For what the C.I.O. did not win, the public has cause to be grateful. If the C.I.O. had been recognized as the sole bargaining agency, a major step would have been taken toward labor control of industry as conducted in large plants. This would have been a control acquired not by economic evolution, or by peaceful and logical argument before the tribunal of public opinion, but by the process of illegal seizure of production facilities and the denial by a few employees of the rights of the many.

The public would be unfairly penalized by the closed shop under the present leadership of labor. As has been proved, it is not a leadership that is committed to winning public opinion to its cause by lawful and orderly procedure. It is rather a leadership distinctly selfish that disregards the final welfare of employees as a whole and the public as a whole.

Concerning the matters now to be the subjects of bargaining, the public has a direct interest. The public must be able to continue to buy its automobiles at prices that will induce a quantity of sales sufficient to support large-scale manufacture. That it cannot do unless the agreements to be reached are such as to allow high efficiency in manufacture and a work week long enough for the needed volume to pass through the tightest bottleneck.

As a result of this strike certain conclusions can be drawn, and from them both industry and the public can benefit:

1. The National Labor Relations Act, of itself, and because it interprets the attitude of the federal government, is a stimulant to industrial strife. This Act should, therefore, be repealed entirely, or amended to define unfair practices on the part of labor, and to make labor responsible under the law to its membership and the public.

2. Industry is in disrepute with the public. If this were not true, the public clamor against illegal possession would have quickly brought the strike leaders a penalty for contempt of court. It would also have brought a storm of protest against the implied acquiescence in nonlegal resistance on the part of government —implied by government's failure to advise the strike leaders publicly that they could not expect to be recognized as a reliable agency for negotiation so long as they were acting outside the law.

3. Industrial relations still is management's biggest job. Industrial relations includes both employee relations and public relations. Moreover the two are not separable. Good public relations cannot be had without having good employee relations. Good employee relations will do more than any other single activity to bring about good public relations.

4. Who won this industrial *strike* will make no difference if only the public can win the industrial *war*. That war will be won only when management and labor work together to create much more wealth so that many more goods and services will be available to constitute a much higher standard of living.

What of the Speed-Up?

Not alone humane but also practical considerations should forbid it. Overworked operators cannot be counted on to turn out a perfect product

K. H. CONDIT
Editor, American Machinist

ONE of the eight demands made by Homer Martin's United Automobile Workers on the General Motors Corporation is that the speed of the assembly conveyors be set by collective bargaining. This demand will bear examination because it is fundamental to the conduct of the whole automobile industry as at present organized.

Mr. Martin and his associates claim that conveyors pace production, and that they are being used as slave-driving weapons in the General Motors plants. They have been broadminded enough to promise to start trouble for the same reason at Ford and Chrysler as soon as they have cleaned up General Motors.

Admitting, for the sake of argument, that production executives are indifferent to how hard their men have to work, it must still be remembered that there is keen competition in the automobile industry and that the finished product must pass rigid inspection before it leaves the factory. Cars of inferior quality will wreck the reputation of any manufacturer in short order, even if only a few get into the public's hands.

Now, it is generally understood in the industry that overworked operators cannot be counted on to turn out a perfect product. If they produce two more cars in a day and both of those cars are below standard, the net result of the attempt to speed up has been a loss.

This same principle operates everywhere, of course. A professor of engineering who has made careful studies of the performance of college students reports that after a boy has been loaded up to his capacity, every attempt to add an hour or so to his schedule results in a lowering of his grades.

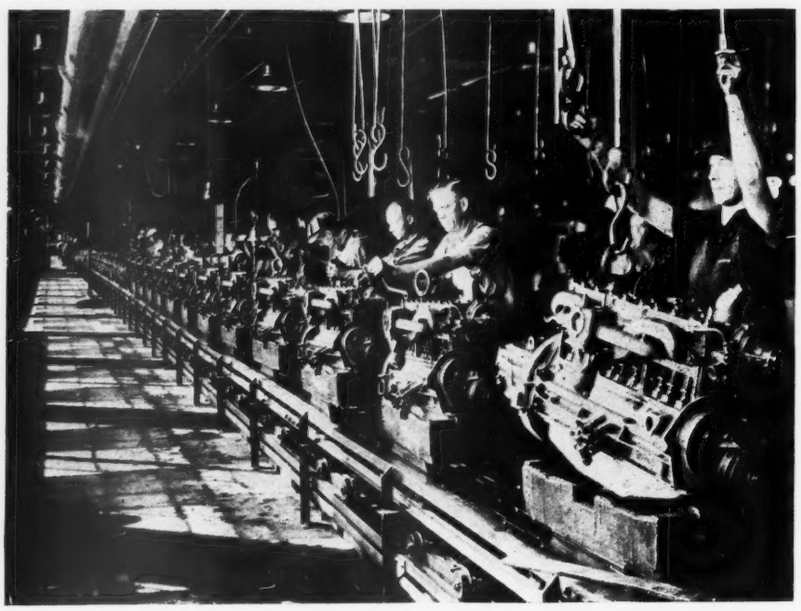
In the automobile industry enough time studies have been made over a long period to give the management a very definite idea of how much work can be done by a man without reduction in its quality. It is hardly reasonable to believe that they will expect more than this performance or that they will take chances of trouble by approaching too close to the limit.

Who Shall Say How Fast?

But we must face the question of who shall determine how fast the conveyor shall run. Not so many years ago an unscrupulous foreman anxious to make a showing might surreptitiously step up the conveyor speed and drive the men on it to unreasonable exertions. Though such an action might be absolutely contrary to company policy and against definite orders, it happened often enough to give the agitator a grievance to complain about.

No one in the industry who knows the General Motors executives places much credence in the charges made by the C.I.O. leaders that inhuman speed-ups are being indulged in, and are serious enough to be a reason for calling a strike. They know that the policy has been to pay a reasonable wage and to expect a fair day's work in return, and to dismiss a man at the end of his shift with sufficient time, spare cash, and energy to enjoy running his car and using the other minor luxuries that the American standard of living puts within his reach.

On the other hand, the general public has no such knowledge of the facts. It is much more likely to hear the broadcasts and read the propaganda of the C.I.O. group and to visualize conditions as being like those satirized in the Chaplin film, "Modern Times." Unfortu-



nately, a good many people in official life are no better informed on this subject than is the general public.

The attitude of the men on a conveyor line towards the speed at which it is being operated, depends a lot on how satisfied they may be with their pay and working conditions. There are plenty of examples of the way in which this attitude varies, but one typical one will suffice here.

Same Old Conveyor

In the packing plant of George A. Hormel & Co. in Austin, Minn., most of the employees were put on a weekly salary basis a couple of years ago. Before that time there was constant bickering about the hardships of being paced by a conveyor that moved too fast. After the change in payment method, according to an article in *Factory Management and Maintenance* for August, 1935, the whole viewpoint changed:

"We have, you see, a given amount of work to turn out in any one day, whether it be 2,000 hogs or 6,000. We set the men to do this task at starting time; when they finish they may go home. Whatever hour they get through, they still earn the same weekly pay. Now the men complain because the conveyor that paces them operates so slowly that they feel they are kept longer hours than necessary. *This is the same conveyor that used to work them to death, the only difference being that we have speeded it up somewhat in accordance with their desires.*"

Processing hams is one thing, manufacturing automobiles by the hundred thousand is quite a different one. Hams are disassembled from the pig, automobiles are assembled from many separate parts and subassemblies each of which represents a major manufacturing problem by itself. In the packing business conveyor speed affects few besides those actually working along it. In the automobile business, however, it affects men elsewhere in the same plants, and men in other plants; it affects transportation methods and timing, and the people in that field.

Adjusting conveyor speed to suit the notions of a union bargaining committee would therefore be a far more complicated question than appears on the surface. In fact, such a policy might easily lead to the same complete breakdown of production about which the Soviets are complaining as a result of the bureaucratic meddling that is inseparable from their political set-up.

Speed-Up Bad Business

It is clearly not to the interest of the automobile executives to speed up a production line to the point where the strain on the men makes human failure a threat. Every practical and humane consideration is against it. Automobiles have to be sold to a critical public. They cannot be sold to buyers who are convinced that they were made by slave-driving methods, and who dislike the maker in consequence.

If the management has allowed conveyor speed to get too high for some of the men working on the conveyor, they should certainly protest, and that protest should be given immediate consideration. If the speed must be held to keep the production machine in balance, more men can be added to the line at the spots where the situation is critical until the load on each one is not more than it should be.

As a matter of fact it is practically impossible to arrange even conveyorized production so that every man involved works at exactly the same speed. The work is such that it is limited by certain bottleneck operations that may be controlled by machine speeds or by the fact that the adding of more men would hamper the movements of all because of lack of room. If there is not room for more men, then the whole organization will have to be slowed down. But any such operation is a major management problem because of the many factors that have to be adjusted and is hardly a subject for arbitration with a group that have not and cannot possibly have all the facts needed for an intelligent decision.

Labor Laws in Great Britain

With labor conditions what they are in this country, plant operating executives will be interested in this study of the Trade Disputes and Trade Unions Act made by the Chamber of Commerce of the United States

THE BRITISH Parliament has gone much further than Congress or any of our state legislatures in setting out the relative rights and obligations of the parties to a labor dispute. Acts of Parliament outlaw wholly some types of strikes; impose numerous penalties, enforceable through criminal prosecution, upon the conduct of labor warfare by prohibited means; deal elaborately with the use of union funds for political purposes; and provide for strict regulation of registered trade unions.

Some Strikes Outlawed

Following the general strike of 1926, Parliament enacted the Trade Disputes and Trade Unions Act of 1927. Section 1 of this Act declares that "any strike is illegal if it: (1) has any object other than or in addition to the furtherance of a trade dispute within the trade or industry in which the strikers are engaged; and (2) is a strike designed or calculated to coerce the government either directly or by inflicting hardship upon the community." The Act also declares it illegal to expend any sums in support of an illegal strike.

In order that a trade dispute may be considered to be within a trade or industry, for the purposes of this section of the Act, it must be a dispute between employers and employees, or between employees and employees, in that trade or industry. The dispute also must be connected with labor conditions of persons in that trade or industry. But employees will be regarded as within the same trade or industry if their wages or employment conditions are determined by the same joint industrial council, conciliation board, or similar agency, or by agreements with the same employer or group of employers.

The provisions of the law of 1927 must be read carefully in order that their exact application may be understood. When so read, they are found not to make illegal a primary strike the object of which is to improve working conditions in the industry, even though the primary strike is so conducted as to include an effort to coerce the government to come to the strikers' assistance.

Nor does the Act outlaw sympathetic or secondary strikes when undertaken merely for the purpose of bringing pressure to bear upon the employers who are refusing demands the primary strikers consider just. What the Act does seek to outlaw is any secondary strike undertaken with a political object, in that there is an intention to compel the government to intervene in the primary strike.

Penalties for Furthering Illegal Strike

Section 2 of the above Act makes it a criminal offense to further an illegal strike. Picketing, for example, no matter how peaceful it might be, would appear to be prohibited where in support of an illegal strike. Violators may be summarily convicted—that is, may be tried without a jury—or may be indicted and tried by jury. Summary conviction carries a fine not exceeding ten pounds, or imprisonment for not more than three months. Conviction on indictment permits imprisonment for as long as two years.

The statute expressly provides that a person shall not be considered to have committed a crime solely by reason of his having quitted work or refused to work.

Illegal Quitting by Employees

The 1927 Act seeks to lessen the danger of strikes in the public service by two new provisions. By one of these, it sharpens the laws against a breach of service contracts by public employees. By the other provision, it restricts the types of trade unions to which established civil employees may lawfully belong.

Striking by employees of certain classes of public utilities (whether such utilities are publicly or privately owned) also was restricted by the Conspiracy and Protection of Property Act of 1875.

Illegal Weapons in Labor Warfare

Parliament also has dealt with the weapons that may be employed in labor warfare. In the Conspiracy and Protection of Property Act of 1875 it provided criminal prosecution for some forms of conduct that previously would have supported private suits only. Section 7 of that Act provides that:

> Every person who, with a view to compel any other person to abstain from doing or to do any act which such other person has a legal right to do or abstain from doing, wrongfully and without legal authority—
>
> (1) Uses violence to or intimidates such other person or his wife or children, or injures his property; or,
>
> (2) Persistently follows such other person about from place to place; or,
>
> (3) Hides any tools, clothes, or other property owned or used by such other person, or deprives him of or hinders him in the use thereof; or,
>
> (4) Watches or besets the house or other place where such other person resides, or works, or carries on business or happens to be, or the approach to such house or place; or,
>
> (5) Follows such other person with two or more other persons in a disorderly manner in or through any street or road,
>
> shall, on conviction thereof by a court of summary jurisdiction, or on indictment as hereinafter mentioned, be liable either to pay a penalty not exceeding twenty pounds, or to be imprisoned for a term not exceeding three months, with or without hard labour.
>
> Attending at or near the house or place where a person resides, or works, or carries on business, or happens to be, or the approach to such house or place, in order merely to obtain or communicate information, shall not be deemed a watching or besetting within the meaning of this section.

The opening words of the section must be read in connection with each

(Continued on page 84)

Open House

BETTER relations with the public will be one of industry's bigger jobs for some time to come. Some of the many ways of tackling this job cost money. Others don't. Among the latter—and therefore available to any plant—is the "open house" type of plan recently used so successfully by the American Rolling Mill Company.

More than 13,500 people—relatives and friends of employees, local business and professional men, and so on—visited the Ashland plant during the three days of open house. Some 10,500 Middletowners took the opportunity of finding out what goes on "down at the mill."

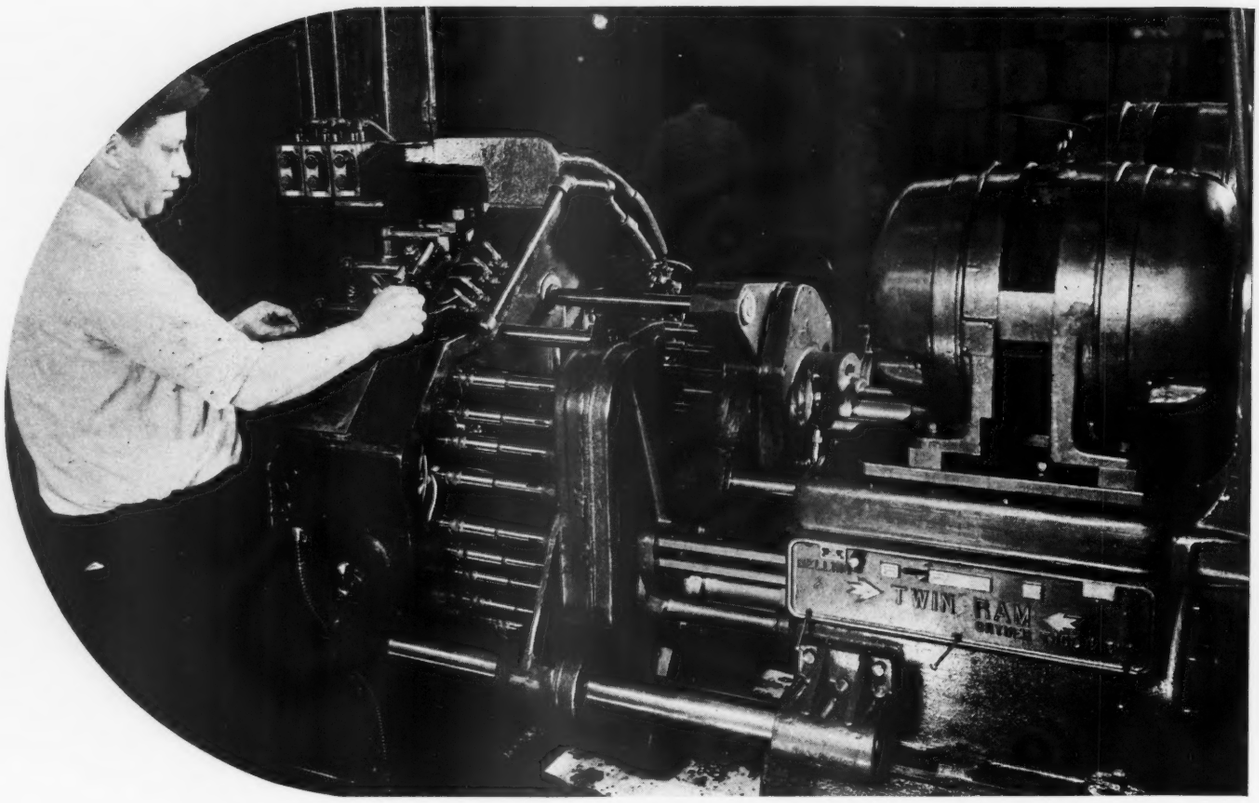
At the end of the trip through the plants, instructive exhibits revealed the progress of the products from iron ore and scrap through the mills into the many complete forms. Superintendents, foremen, and employee representatives acted as hosts, also planned and arranged the exhibits.

Above. 13,500 visitors went to the party at Armco's Ashland, Ky., plant

Below. Some of the Middletown, Ohio, folks who took the opportunity of finding out what things are like "down at the mill"

Above. Friends and relations, local business and professional men, all were invited

Left. Superintendents, foremen, and employee representatives planned and arranged the displays, acted as hosts



To buy or not to buy this machine. That was the question Plymouth had to answer

Plymouth Bought

Found two new machines would save 3.48 cents per motor, pay for themselves in 421,120 motors. Here's Plymouth's procedure for determining when to buy

C. B. GORDY
Detroit Editor

IN RECOMMENDING the investment of capital in new manufacturing equipment, the master mechanic at the Plymouth Motor Corporation is guided by three considerations — quantity, quality, and cost. Any one of the three may dictate change. An increase in the requirements due to a jump in sales may go beyond the capacity of existing equipment. To install more machines of the same type may require more floor space than is available and the whole method of doing the operation may have to be revised. The incessant increase in quality requirements and the constant demand for lower unit costs may lead in the same direction.

When a new model is being prepared, each part is studied, the machines used are listed, and the cost is calculated according to the present way of doing the job. If a new method exists or may be devised, using new machines or revisions of existing machines, it is set up and a cost figured. If savings are sufficient, this revision, and other revisions similarly made, are recommended to management, totaling large sums of money. At this time, however, details of the operating methods to be used are not given, but only the amount of money it is proposed to spend for each operation, and a summary by manufacturing part numbers.

In the normal course of events these recommendations, once they have been accepted and the equipment has been installed, will last out the life of a model and perhaps a great deal longer, since a complete redesign of all parts is not by any means the usual thing.

Intra-Model Changes

It frequently happens, however, that it is advisable to introduce changes during the life of a model. Improvements made by machinery manufacturers may offer large sav-

COMPARATIVE COST OF DRILLING AND REAMING BOLT HOLES AND DRILLING ANCHOR HOLE ON MODEL P, P_2 CONNECTING ROD NO. 620,114-5

PRESENT METHOD			PROPOSED METHOD	
Drill $\frac{11}{64}$" anchor hole	3 spdl. D.P. B 7,367	3 spdl. D.P. H 3,859	Drill, ream bolt holes and $\frac{11}{64}$" anchor hole	New	New
Book value	000.00	318.30	Mach. cost	7,328.00	7,328.00
Prod. per hr.	361	361	Prod. per hr.	350	350
Rate	.82	.82	Rate	.82	.82
Direct labor	.0023	.0023	Direct labor	.0023	.0023
Drill bolt holes	D.P. B 5,382	D.P. 21,794	D.P. 21,133	No. of machines – 2 No. of operators – 2	
Book value	000.00	691.00	916.00		
Prod. per hr.	255	255	255		
Rate	.82	.82	.82		
Direct labor	.0032	.0032	.0032		
Ream bolt holes	D.P. 17,068	D.P. 19,028			
Book value	000.00	38.25			
Prod. per hr.	310	310			
Rate	.82	.82			
Direct labor	.0026	.0026			
No. of machines – 7 No. of operators – 7					

SUMMARY

Book value of present machines	$ 1,963.55
Total cost of proposed machines	$14,656.00
Floor space, present method	98 sq. ft.
Floor space, proposed method	56 sq. ft.
Floor space, saving	42 sq. ft.
Direct labor, present method	$ 0.0081
Direct labor, proposed method	.0023
Direct labor, saving per piece	$ 0.0058
Pieces per motor	6
Direct labor-saving per motor	$ 0.0348
Motors required to liquidate expenditure	421,120

ings in costs. Frequently designs of new equipment or methods under development for some time may come to fruition and offer sufficient advantages in quality or in cost reduction to warrant their installation. In such cases, a comprehensive statement of what it is proposed to do is given to management.

Case History

An example is afforded in the operations of drilling and reaming the bolt holes and drilling an anchor hole on a connecting rod. Management was given a complete analysis of the entire job with each operation of the present way of doing it compared with the proposed way, as shown in one of the illustrations. This job involved the designing of two special types of horizontal drilling machines, one a single-end drum and the other, for the connecting rod caps, a two-way drum type. Two machines of each type replaced 15 vertical drill presses.

Following this pictorial comparison of methods, management was given an analysis showing the book value, production per hour, labor rate, and direct labor cost per piece for each operation on the present set-up. Then, with the substitution of the cost of the new equipment for the book value of the old, the same information was provided for the proposed way of doing the job.

Using assumed figures for purposes of illustration, this information covering the comparative cost of drilling and reaming bolt holes and drilling the anchor hole on a connecting rod is summarized in the accompanying chart.

The gist of the matter is that by this method management is given all the pertinent facts, arranged in a comprehensive manner, that are necessary for a decision. No room is left for vagueness. There is no necessity for verbal interpretation. The plan is stated. It is compared with the present way. And the results in costs and quality are given.

COMPARATIVE CHART-DRILLING, REAMING BOLT HOLES AND DRILLING $\frac{11}{64}$" ANCHOR HOLE ON MODEL P-1 P-2 CONNECTING ROD NO. 620,114-5

PRESENT METHOD-USING VERTICAL DRILL PRESSES 7 MACHINES 7 OPERATORS	PROPOSED METHOD-USING SINGLE-END HORIZ. DRUM TYPE DR. MACH. (2 PIECES AT A TIME) 2 MACH., 2 OPERATORS
Drill $\frac{11}{64}$" anchor hole 1-No. 2 B, 3-spindle D.P. 1-No. 2 B, 3-spindle D.P. Total spindles used, 4	Drill bolt holes $\frac{1}{3}$ way Total spindles, 8
	Drill bolt holes $\frac{2}{3}$ way Total spindles, 8
Drill bolt holes (6 pieces at a time) 3-drill presses with 12-spindle multi-heads Total spindles used, 36	Drill $\frac{11}{64}$" anchor hole Total spindles, 4
	Drill bolt holes through Total spindles, 8
Ream bolt holes D.P. with 2-spindle multi-heads Total spindles used, 4	Rough ream bolt holes Total spindles, 8
	Finish ream bolt holes Total spindles, 8

Rate Setting with Battery Constant

ROBERT S. MILLER
The McKinnon Industries Limited
St. Catharines, Ontario

TIME-STUDY engineers are frequently called upon to set rate standards for parts machined on automatic or semi-automatic machines grouped in what is known as a "battery," in which one operator is assigned to run all or part of the machines.

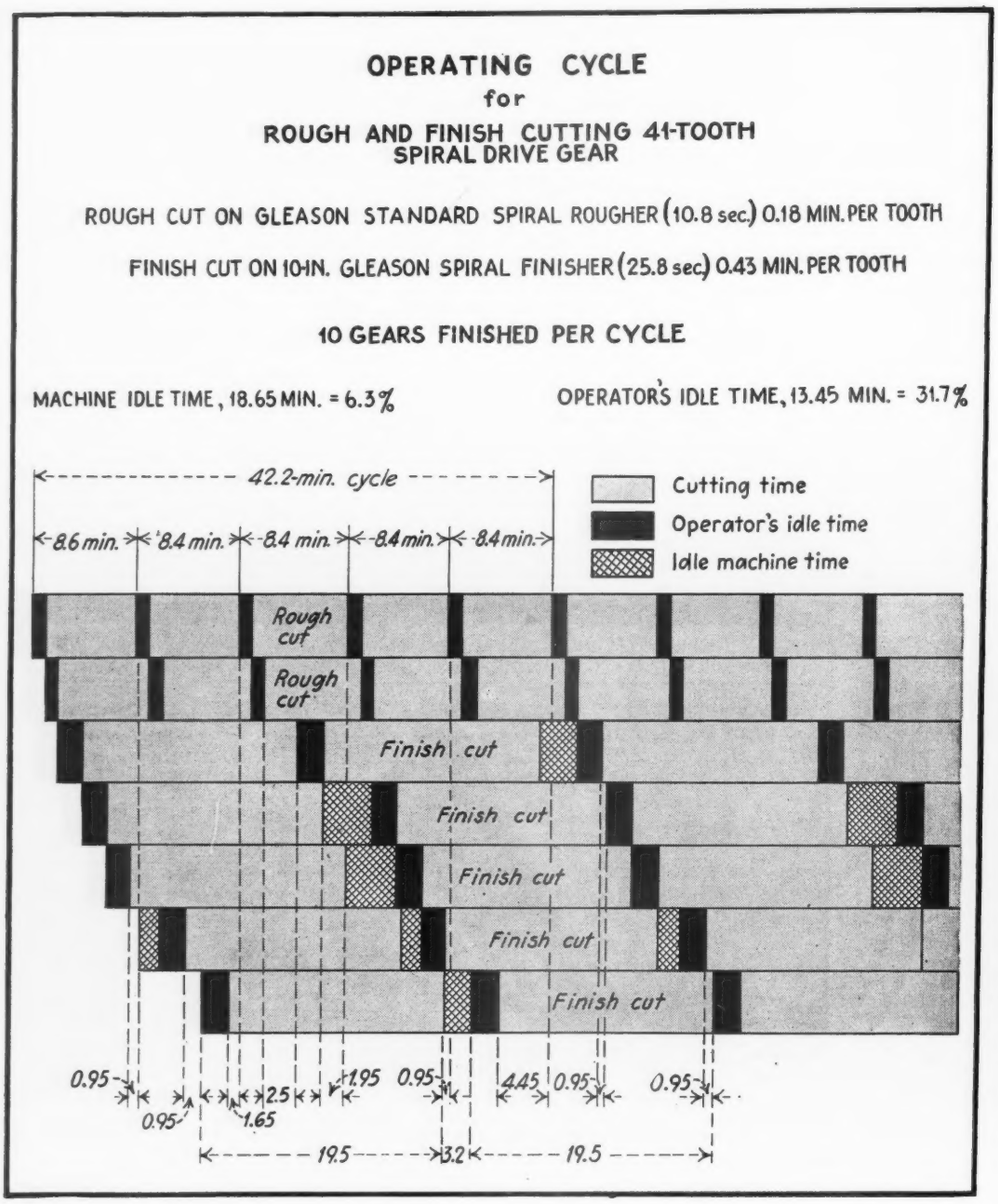
For instance, one operator is assigned to run five automatic screw machines making a variety of parts, each part having a different index time. If one of these machines has an index time of 1.25 min. and we allow 20 per cent for personal and tool delays, then by the usual method of arriving at the standard we should add 20 per cent to the index time of 1.25 min. and divide by 5, the number of machines operated by one man, which would be 0.30 min. or 0.005 hour for each piece $(1.25 + 0.25 = 1.50 \div 5 = 0.3)$.

The number of pieces per hour produced by the machine, allowing 20 per cent for delay, would then be 80 per cent of 60 min. divided by 1.25, or 38.4 pieces per hour $(60 \div 1.25 = 48 \times 0.80 = 38.4)$.

As there are five machines operated by one man, the number of pieces produced per hour on any machine multiplied by the standard per piece must equal one-fifth of an hour. But 38.4 times 0.005 equals only 0.192 hour, which is 0.008 hour or 4 per cent short, so that it is necessary to find the "battery constant" from which we can calculate the correct standard for this or any other machine in the battery of automatics.

If one man operates five machines at 80 per cent of their theoretical capacity, then $1/5 \times 0.80 = 0.25$, which is the battery constant. The standard for any piece made on any machine in the battery is the index time multiplied by the battery constant—in the above case, $1.25 \times 0.25 = 0.3125$ min. or 0.00521 hour, the correct rate standard per piece produced.

The standard multiplied by 38.4 pieces produced per hour by the machine is exactly one-fifth of an hour, proving the accuracy of the method.



Gear Cutting

On one occasion, to meet a cut in the selling price of an automobile third member assembly, the gear cutting department was called upon to contribute its share of the cost reduction to meet the new selling price.

(Continued on page 94)

From Pickling to Machining Automatically

By trolley conveyor. And a simple problem, were there not the trivial matter of getting forgings out of pickling baskets into conveyor buckets. Here's how such a transfer—automatic, of course—can be made in anybody's plant

ARTHUR VAN VLISSINGEN, JR.
Consulting Editor
From the experience of
Muncie Plant of Chevrolet Motor Company

•

LAYING out the handling of gear blank forgings from the pickling tank to the machine shop presented difficulties. We wanted the method to be entirely automatic if possible. The gear blanks could obviously go to the machine shop most economically by a trolley conveyor, in buckets that could be unloaded at the primary machine operations where required.

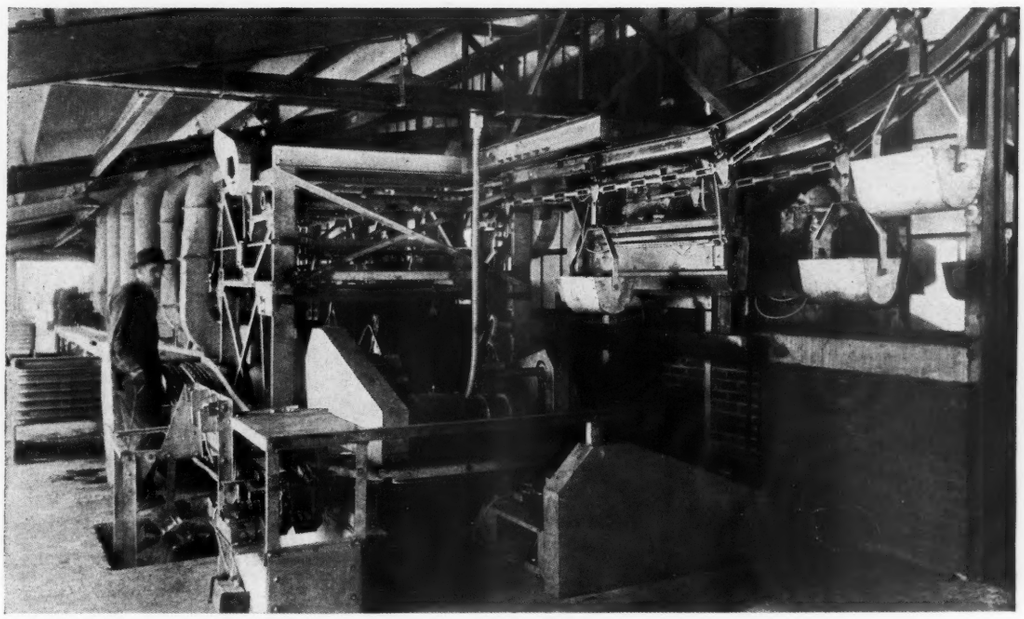
Our original idea was to have an operator stand at the end of the gravity roller discharge from the pickling tank, unload the pickling baskets by hand, and place the blanks in the trolley conveyor buckets as they passed him. The trouble was that, in addition to requiring a man for the job, it turned out to be too heavy a task. What we needed was an automatic transfer station.

Gear blanks are of a variety of shapes and sizes. They vary from practically flat disks about 2½ in. in diameter and ¾ in. thick to cluster gears that have a central hub carrying three diameters of disks integral. When they come from the forge shop to pickling, any one type of gear blank is loaded into a bronze basket of lattice construction, about 1 ft. wide, 1 ft. high, and 3 ft. long. A basket holds over 400 lb. of forgings—anywhere from 50 or so of the larger gears to more than 100 of the smaller blanks.

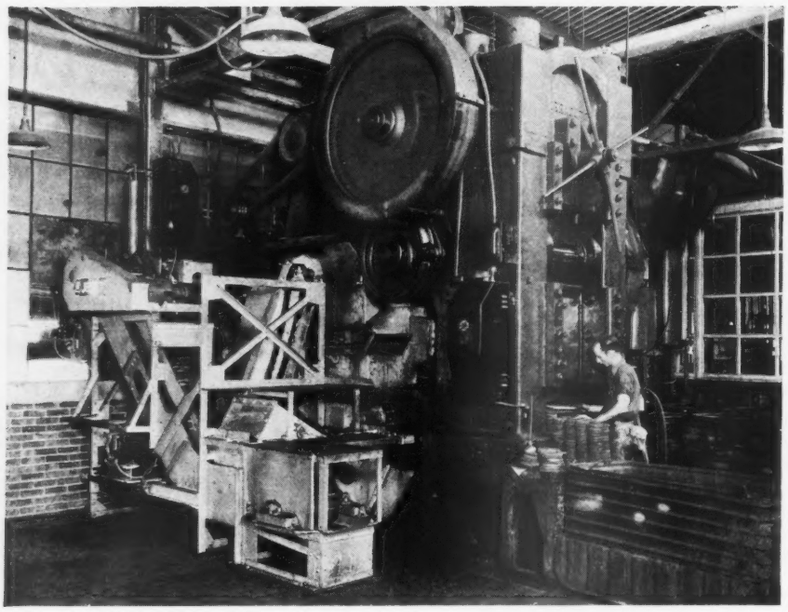
When the basket arrives at the end of the pickling machine, it is automatically deposited on a section of gravity roller conveyor.

It is at this point that the transfer problem arose. The task was to empty the baskets—into round-bottomed steel buckets on the trolley conveyor that would take them to the machine shop. These buckets are spaced 4 ft. apart and travel at the rate of 20 ft. a minute. Each basket holds about five times as many gear blanks as one of the buckets can hold. Moreover, the conveyor to the machine shop is considerably higher than the level at which the baskets leave the tank.

You can see the problem involved in designing such a conveyor transfer station to be wholly automatic. It must divide the basket's load into five bucket loads. It must elevate these gear blanks and place them in the buckets. It must return the empty basket to a conveyor that will take it back to the head of the pickling line. Our engineering department grasped some of the solution, but not all. The equipment manufacturer—the Jeffrey Manufacturing Company—put engineers to work on it and made progress. Working together, we finally licked the problem. It is described in this article with the idea that its essen-



Automatic dumping station with pickling basket in discharge cradle ready to be dumped. Forgings drop to apron conveyor, pass through wall to bucket loading station. At right, trolley conveyor with round-bottomed buckets used to transfer forgings to machine shop. At the left is the conveyor that returns the baskets to the receiving end of the pickling tank



Bucket loading conveyors adjacent to coining press. Coined forgings and straight forgings are handled and loaded separately and automatically into trolley buckets that take them to machine shop

tials may help someone who is faced with a similar difficulty.

In its essentials the problem involved a basket dumping station, a basket return conveyor, and two apron-type conveyors for feeding the forgings to the conveyor buckets. The dumping station was the difficult apex of this problem. It consists of a pivoted cradle resting on a turntable. The bottom of the cradle is fitted with gravity rollers. As a basket comes from the pickling tank, it rolls into this cradle. When the basket enters the cradle, its entrance actuates a limit switch and starts a motor. The motor tips the cradle forward until the forgings are dumped onto the first apron conveyor beneath. The basket remains in the cradle.

Following Forgings

Let us now temporarily leave the dumping station and follow the forgings. The forgings fall upon the apron conveyor—not, however, upon an unbroken surface. The conveyor is divided into large sections just adequate to hold a basketload of gear blanks. Each large section contains four transverse dividing plates, which thus divide the basketload of gear blanks into five approximately equal fractions.

This first conveyor is horizontal underneath the dumping station and rises toward its discharge end to gain height. The second apron conveyor lies parallel to the first and is similar to it except that the lifting blades are low rather than high and are spaced 16 instead of 8 in. apart. The foot end of this unit lies horizontal to receive the forgings through a chute from the first unit, then rises to gain the additional height necessary to discharge the forgings through a chute into the trolley conveyor buckets.

Direct to Machine Shop

Some gear blanks are delivered direct from here to the machine shop. A small proportion must first pass through a coining press. Each trolley conveyor bucket receiving gear blank forgings for delivery direct to the machine shop is provided with lugs which operate a limit switch in such a way that the bucket is properly located at its loading point before the switch is actuated. As this happens, the trolley conveyor stops and the motor operating the two apron conveyor units starts up.

Until now these apron conveyors have not moved. Now the first apron conveyor moves forward 8 in. and thus delivers one-fifth of a basketful to the second apron conveyor. Simultaneously this same volume of forgings is delivered to the trolley conveyor bucket by the second apron conveyor moving forward the distance of one of its lifting blades. Both apron conveyors stop automatically after the above-described movement, and do not start again until the next trolley bucket lug actuates the limit switch.

Safety devices insure accurate and safe operation of this teamed-up equipment. Suppose that five buckets have been thus filled by five successive movements of the apron conveyors. And suppose that the 40-in. compartment of the first apron conveyor, with its five subdivisions, is empty. This can happen only if an incoming pickling basket has not been dumped. Under these circumstances a trolley conveyor basket lug passing over the limit switch will not cause the two apron conveyors to move. They remain at rest until a basketful is dumped upon the empty space on the first apron conveyor.

Won't Dump Unless —

Or suppose that an incoming basket enters the cradle before five trolley buckets have been filled and five corresponding movements of the apron conveyors completed. Under these conditions the basket's entering the cradle will not cause it to dump until the fifth movement of the apron conveyors is completed.

We now have followed the forgings destined for delivery straight to the machine shop, and have them safely loaded in the trolley buckets. It is time to go back to the point where we noticed that some few of the small flat blanks must go through a coining press before they can move to the machine shop. The coining press is adjacent to the discharge end of the pickling tank and also adjacent to the loading point of the trolley conveyor.

Gear blanks for coining are discharged from the pickling tank just like other blanks, are dumped into the apron conveyor, and ascend to the point where normally (if they were not destined for coining) they would dump onto the second apron conveyor. Instead there is a fly-valve in a two-way chute at the discharge end of the first apron conveyor. When gears that must be coined emerge from the pickling tank, the man who tends the tank throws over the fly-valve. By thus setting the valve he delivers the forgings, not to the second apron conveyor, but to a tote box. When this valve is set, it also sets a switch that causes the first apron conveyor to run at double its normal speed. At the same time a clutch is used to disengage the second apron conveyor, which thus ceases to load the trolley conveyor buckets.

After forgings have been coined, they are delivered to the trolley buckets by two small apron conveyors. One of these passes the

foot of the press; the second rises at right angles to deliver to the trolley buckets. At the discharge end is a receiving hopper with a spring-suspended bottom. When about 40 lb. of coined forgings have been received, a limit switch operates to stop both conveyors.

Some of the trolley conveyor buckets carry lugs that will not operate the limit switch used for direct loading, but will operate a second limit switch. When these particular buckets engage their switch, the trolley conveyor stops with the bucket in position to receive the contents of the hopper of coined forgings. At the same time a solenoid operates to open the hopper gate, discharging the contents of the hopper into the trolley bucket. The trolley conveyor then moves forward again, and the gate on the hopper closes to receive the next lot of coined forgings. At the same time the two apron conveyors that handle coined forgings start to run.

Simultaneous Loading

Since the coining press may be run at any time following an accumulation of forgings to be coined, it is arranged that both kinds of loading—from the pickler direct to the trolley, and from the coining press to the trolley—may go on simultaneously. The two loading stations are 4 ft. apart, and this is the interval at which the steel trolley conveyor buckets are spaced.

By now this description has reached the point where both types of forgings are in the trolley buckets. The latter are carried by a spring suspension in such a way that if a bucket is already loaded—which means that it was overlooked when it passed through the machine shop—the spring is elongated, allowing the bucket and its lug to drop down so that the lug will not engage the limit switch. Thus any danger of loading an already loaded bucket is prevented.

The conveyor bucket, once loaded, travels several hundred feet to the machine shop. Here the buckets travel along the outer edge of the machines, the shop being laid out so that primary machine operations are all performed at the outer edge of the room. The conveyor is low enough so that the machine operators can see what is in each bucket, and it is the duty of each operator to catch the bucket containing his type of material. The buckets are made on horizontal axles, with hand latches at one end. The machine operator notices a bucket of his blanks, unlatches it as it passes over his material box. This dumps the bucket, the machine operator latches it back in upright position, and it resumes its empty way.

A while back we left the dumping station to follow the blanks through their course along the trolley conveyor. The basket had entered its pivoted cradle on the turntable, had been dumped, and the empty basket remained in the cradle.

Basket Goes Back

Immediately after dumping, and while retaining the basket, the cradle returns to its upright position. The turn table rotates 90 deg. contraclockwise and stops. The cradle now tilts in the opposite direction from its previous tilt. The basket rolls out and lands upon the return conveyor. Now the cradle rights itself. The basket rolls along its return conveyor toward the head of the pickling tank. As it moves, it strikes a limit switch which actuates the turntable motor to turn the turntable 90 deg. clockwise, back to its original position and ready for the next basket.

The entire installation is automatic. As noted, the only manual operation comes when a valve and a clutch must be used to change the handling of flat gear blanks for coining. At the same time it is possible to keep this system moving by manual electric controls alongside the dumping station. It is necessary to have a way to start and stop any part, since a mishap such as a forging falling in the wrong place might cause trouble if allowed to go uncorrected.

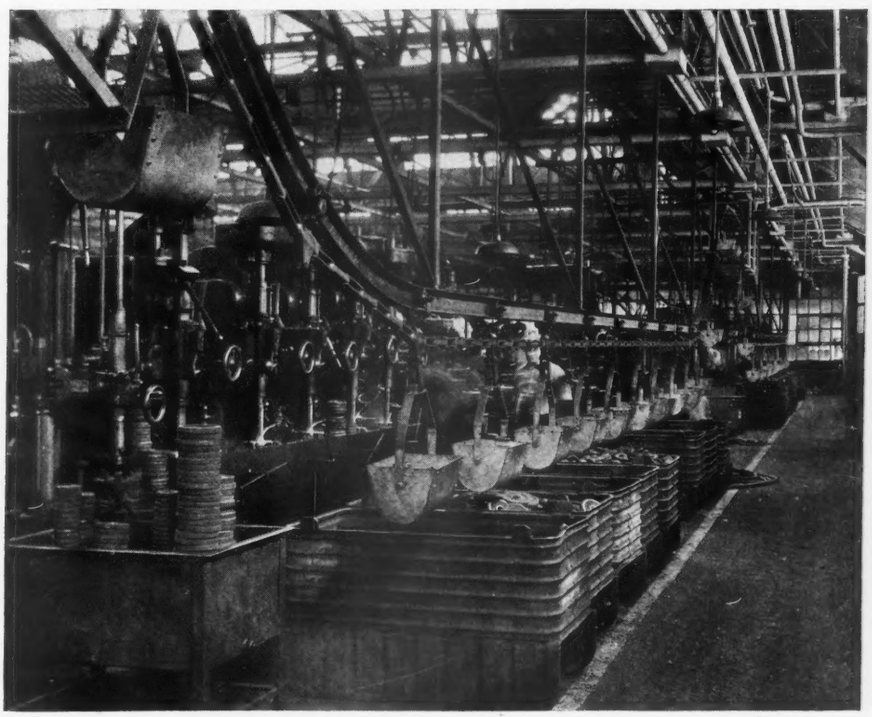
When the system is thus stopped, an electrician comes on the run, since to get the system functioning smoothly once more means primarily to find the point in the electrical controls where they have been thrown out of synchronization. This happens on the average of not more than once a day, and requires very little time.

The man in charge of the pickling tank also keeps an eye on the system, and since his principal duty in this respect is to throw the valve and clutch when forgings for coining are coming, or to stop the movement when anything goes wrong, he is by no means overworked.

Cost, $2 a Day

The cost of operating the system is therefore practically nothing. On a test we found that it uses less than $2 worth of electricity a day in full operation. The entire installation, including the hundreds of feet running into the machine shop, with all its conveyor buckets, and its auxiliary equipment including turntable, apron conveyors, basket return conveyor, and what not, cost a surprisingly small amount of money. We know that it is infinitely more satisfactory and economical than any other set-up we knew how to devise.

Trolley conveyor passes over tote boxes in machine shop. Machine operator notices bucket of his blanks, unlatches it, dumps blanks. Then he latches bucket, which goes back to loading station



Less Walking More Working

Motion-economized layout cut daily "constitutionals" from 2 miles to 1800 feet, saved 30 per cent in cost of cutting lumber

S. R. TERANES
Industrial Engineer, Hamilton Manufacturing Company
Two Rivers, Wis.

MOTION STUDY has become one of the most useful tools of management. The plant manager who is seeking ways and means of reducing costs and increasing production will find it to his advantage to learn how to use it. Rearranging equipment or work place, bringing raw materials closer to the working area, making holding clamps or fixtures, using portable tools, eliminating wasteful motions by operator—these are just some of the ways to improve an operation.

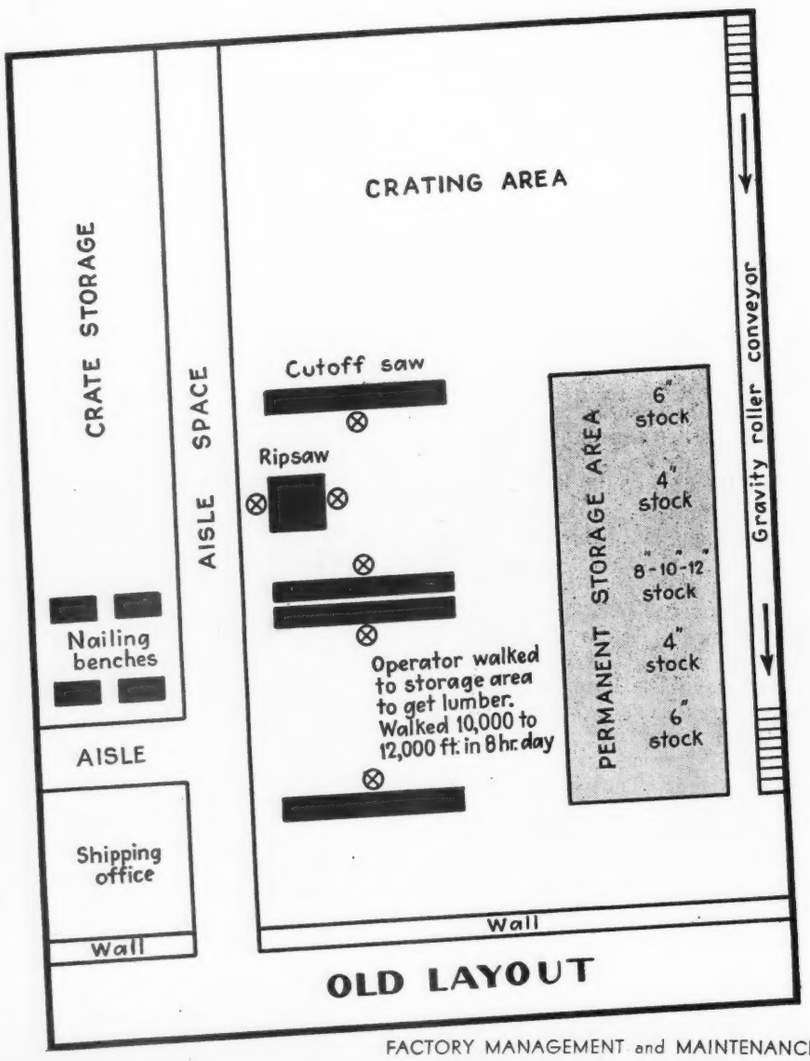
Never a Speed-Up

Motion study is often interpreted by the shop man as a speeding-up process, one of the newfangled ideas "efficiency men" are always trying out in the shop to get more production per man. Others think that its usefulness is limited to fast repetitive finger operations, preferably light assembly work. It is a fact that motion study may almost always be applied to such jobs with profit, but there are many other places where it can be used to advantage. Through the elimination of unnecessary motions and not through speeding up, the operation time may be cut and fatigue reduced, thus enabling the operator to perform more useful work.

Some of the most profitable results from motion study can be obtained if time and effort is expended to get the organization motion-minded, especially the time-study division. They are able to note inefficient operations and suggest improvements that heretofore have been overlooked.

In our plant we are applying the principles of motion study with profitable results. In our packing department we have four cut-off saws cutting lumber for the crates in which we pack our product. We use a good deal of this crating lumber—upwards of a carload a week. It is bought in five standard widths, each width in two thicknesses.

Analysis of this operation brought out these facts. The car of lumber was spotted at one end of the building. The lumber was removed, placed on a gravity roller conveyor, and carried to the various sections provided for its storage. The unloading space was large enough to hold three carloads at one time. Lumber of a certain width and thickness was distributed to each section. The cut-off saws were arranged in rows about 20 ft. away from the storage sections. Each

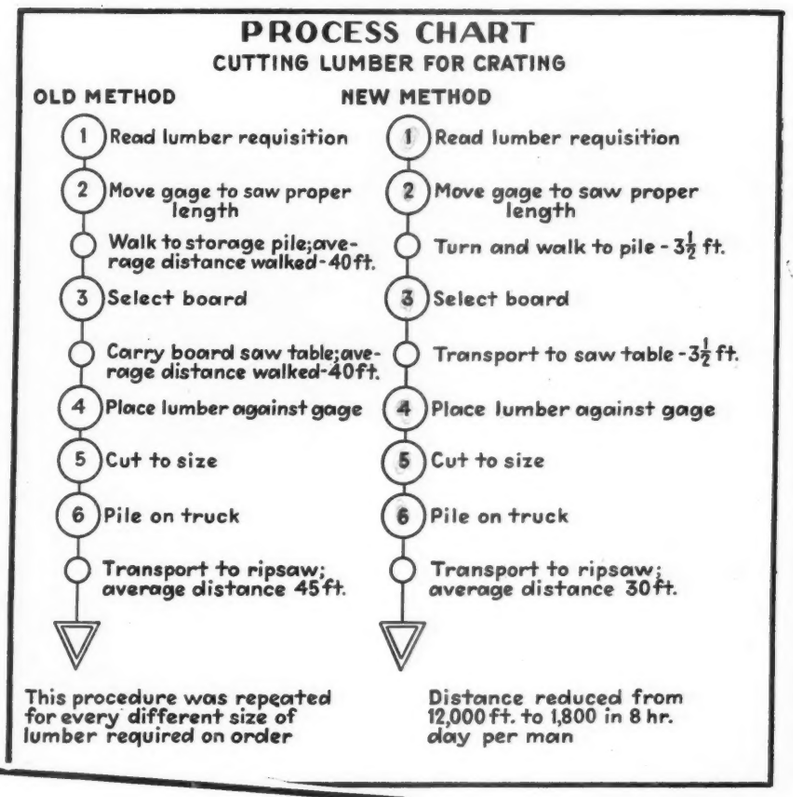


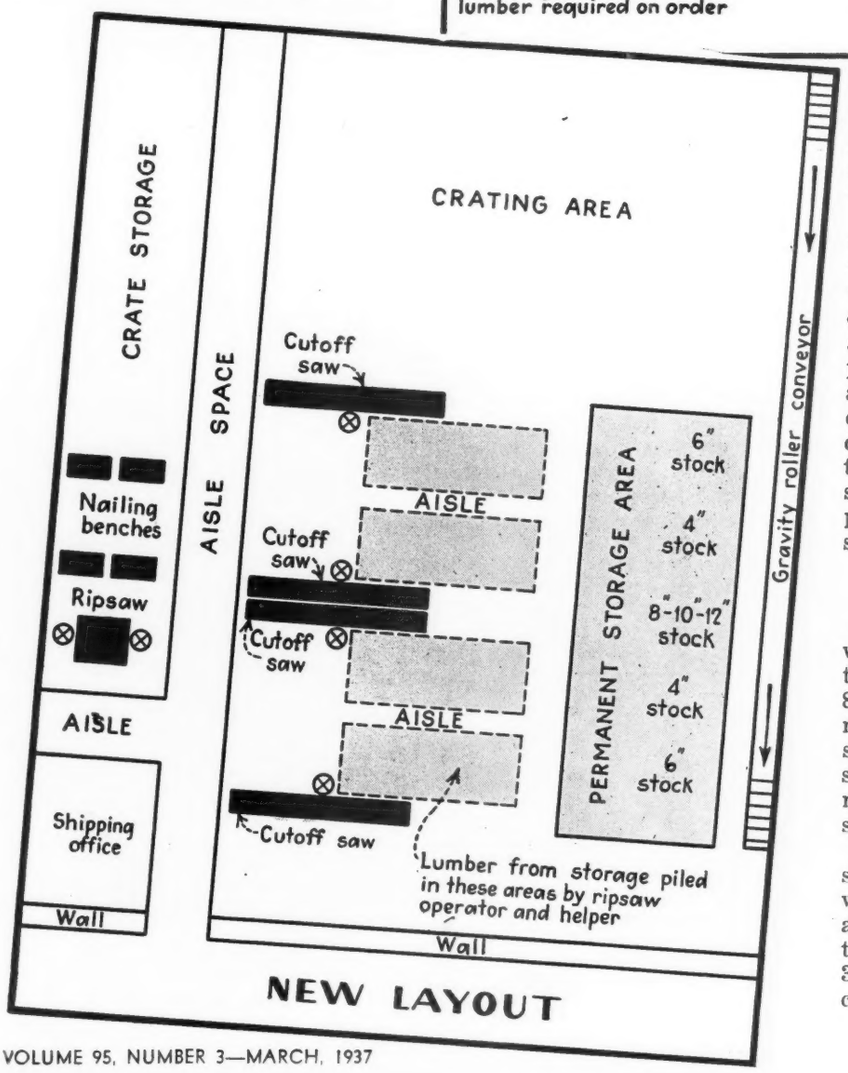
saw operator read his lumber requisition, then walked over to the bin that contained the size of stock he desired, picked up one or two boards, returned to the saw, and cut them up to the dimensions required.

Checked Distances

Upon checking the distance traveled in an 8-hour day, it was discovered that it averaged 10,000 to 12,000 ft. per man. Figuring that this walking was done at a very slow pace because part of the time the operator was carrying a load, it amounted to a considerable part of his working day. Multiplying this by 4, we were paying a substantial amount for fatiguing, non-productive walking time.

Obviously the thing to do was to reduce walking time to a minimum. The first thought was, why not pile only a part of the lumber in the departmental storage area but pile it near the saws, the balance to be stored out in the yard and brought in as needed? This procedure would have added an expense of approximately $1,800 per year for rehandling, however, so could not be considered.


PROCESS CHART
CUTTING LUMBER FOR CRATING
OLD METHOD
1 Read lumber requisition
2 Move gage to saw proper length
Walk to storage pile; average distance walked - 40 ft.
3 Select board
Carry board saw table; average distance walked - 40 ft.
4 Place lumber against gage
5 Cut to size
6 Pile on truck
Transport to ripsaw; average distance 45 ft.
This procedure was repeated for every different size of lumber required on order
NEW METHOD
1 Read lumber requisition
2 Move gage to saw proper length
Turn and walk to pile - 3½ ft.
3 Select board
Transport to saw table - 3½ ft.
4 Place lumber against gage
5 Cut to size
6 Pile on truck
Transport to ripsaw; average distance 30 ft.
Distance reduced from 12,000 ft. to 1,800 in 8 hr. day per man



Then the idea was conceived of moving the saws 4 ft. farther away from the storage sections. This would allow a pile of material near each saw with an aisle between it and the storage section. Lumber placed near the saws was to be of assorted widths and thicknesses in order to facilitate economical handling and cutting. The study showed that the man operating the ripping saw would have ample time to replenish the piles from permanent storage at regular intervals.

More Production

By carrying out this arrangement, walking time per man was reduced to approximately 1,800 ft. for an 8-hour day. The walking time could not be entirely eliminated because some of the odd-size lumber was still some distance away, and it was not practical to place it with the stock regularly used.

Production per man has increased steadily each month since the layout was changed. We have now been able to transfer a part of the crew to other work, thereby effecting a 30 per cent saving in the cost of cutting crating lumber.

If her boss is "lovely to work for," she cares not too much what the work may be

Women Are More Adaptable

DONALD A. LAIRD
Rivercrest Laboratory
Hamilton, N. Y.

WOMAN'S rather distinctive emotional make-up is reflected partly in her interests. In some regards these interests of women work to their marked advantage in industry. Their interests are not as definitely crystallized as are men's around one or two particular vocations. Women's interests in work are broad, general, non-specific. Women are not so wrapped up in one specific job.

Not So "Choosey"

Since they have no consuming interest in one job, but just a general interest in doing something, they are less "choosey" about the job they select. This is one reason why it is often easier for a woman to get a job. She will take the first thing that looks good to her.

Another way of stating this is that the average woman is more adaptable to a wide variety of jobs. If her boss, as the 21-year-old private secretary said, is "lovely to work for," she cares not too much what the work may be.

This characteristic is also reflected in the fact that women are more likely to be satisfied with their work. One-third of the men, numerous studies have shown, are dissatisfied with their work. With women the percentage of those who are dissatisfied rarely runs to half this figure. And it is chiefly among the lower grades of women workers that dissatisfaction is large.

Ten per cent of office clerks are dissatisfied with their work, Dr. Grace E. Manson found. Going up the scale she found, however, that only 5 per cent of stenographers were dissatisfied. Among private secretaries 98 per cent are completely satisfied with their jobs.

Usually looking forward eventually to having some man support her, the typical woman worker can be said to be unambitious. This makes her emotionally suited to the thousands of jobs that cannot hold out an inducement of promotion or responsibility. How her boss treats her, and the working conditions are the important things in her estimation of job satisfaction. Dr. Lorine Pruette recently made an intimate study of 328 working women. Seven per cent of them had complaints to make about their working conditions, 5 per cent about their earnings being too small, and only 3 per cent about lack of advancement.

So give them working conditions that measure up to feminine interests, and a chance to indulge their feminine yen to look their best.

(This is the second of several articles by Dr. Laird on "Things Worth Knowing If You Employ Women." The third article will appear in an early issue.—ED.)

Among private secretaries, 98 per cent are completely satisfied with their jobs

Truckers and Sweepers on Bonus

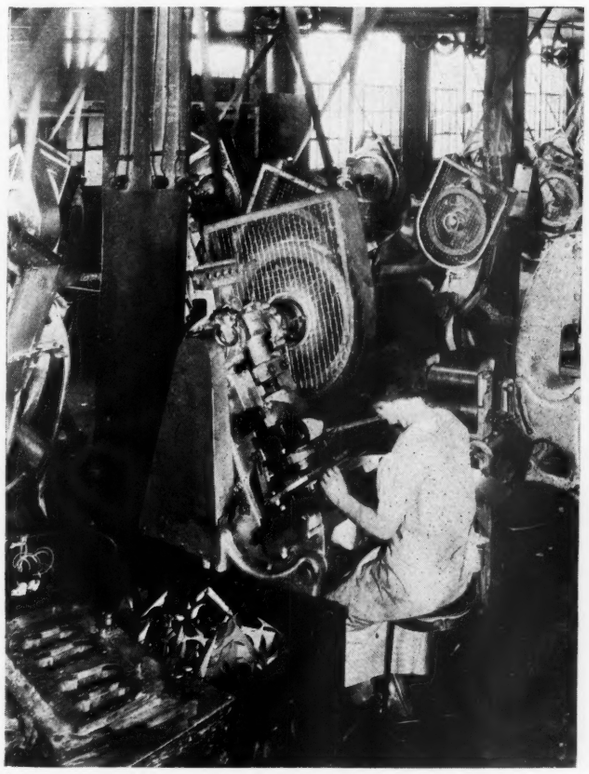
Eleven men do 19 men's work since this 50-50 bonus plan was set up. Men earn more. Handling is no longer haphazard. Plant is cleaner

A. F. GOBB
Plant Superintendent McCord Radiator & Mfg. Co.
Wyandotte, Mich.

EARLY in 1936 we came to the conclusion that our trucking and sweeping costs were too high. Worse still, the force engaged in this work was indifferent and dissatisfied. The answer was a group incentive plan, installed last June. Within three months it reduced handling and cleaning costs here in the Wyandotte plant by more than 40 per cent. The men earn more money, give better service, and are more interested in the company and in their work than before.

Nothing But Gaskets

Although this plant manufactures only gaskets, it produces some 20,000 items varying in size from a 42-in. cylinder head gasket to one 3-16 in. in diameter. In the first eight months of 1936, for example, over 44,000,000 spark plug gaskets were produced. Materials used—aluminum, copper, brass, monel metal, stainless steel, and asbestos—have a high unit value. Scrap classification and segregation have an important bearing on costs. Reduction of scrap constitutes one of the merits of the incentive plan that is now in use.



Moves to and from machines are made promptly. There always used to be an acute shortage of containers, both for product and for scrap. Now there are always plenty of each kind

Prior to June 1 the materials handling and cleaning force was under diverse leadership. A yard gang was engaged in unloading cars, delivering the material to the stockroom, handling scrap, baling it, and loading it into outgoing cars. Cleaning the machinery and the floors was handled in each department by men reporting to the foreman. The latter were naturally interested in output, so little attention could be given to the activities of these cleaners. Stock was moved to and from machines by certain individuals, while others cleaned floors and machinery.

Observation disclosed that the "stretch-out" system was working in reverse order. Productive workers who were temporarily out of work because of a breakdown or a schedule failure were transferred to sweeping and cleaning, and the daywork ticket was charged to that account. Net result of this practice and of the indifference of the gang as a whole was a cost for plant cleaning and materials handling that was ever so much greater than it should have been.

Under the new incentive plan, the departmental sweepers and materials handlers were added to the yard gang, making a total of 19 men. These men were placed in one department under a foreman. They were not assigned permanent places in the factory except as their foreman might decide for the sake of convenience and efficiency. For example, the full time of one member of the gang was required in servicing the tumbling barrels with material, loading and unloading the screening machine for segregation of scrap, and cleaning up around a large press adjacent to these operations. Since, with an occasional exception, they did not have permanent locations, a plant or functional viewpoint came to predominate within the group.

Standard Ratios Set

Average productive hours for the previous five months were then calculated. Hours spent during the same period for yard labor, such as car loading and unloading, scrap handling including baling, trucking service to machines, oiling machinery, and sweeping and cleaning were also averaged. The ratio of the latter to the former was calculated, and turned out to be 9 per cent. However, management realized that an indeterminate amount of time had been charged by productive workers to some of these activities while they were really working on

their piece rate, so established 5.7 per cent as the normal ratio of 100 per cent efficiency. One-half of all efficiencies above this norm is given to the men as an addition to their hourly rate.

Half Goes to the Men

If, let us assume, 84 hours at a given schedule represent standard efficiency for these occupations, and if the gang requires only 74 hours to perform them, one-half the savings—5 hours—goes to the men. This represents 6.7 per cent of the hours taken and is added to the hourly rate of each man for the pay period.

The plant manufactures to jobbers' orders, consequently its schedule is based upon maintaining a balanced stock inventory as gaged by previous sales of each item. A budget of productive hours from day to day may consequently be established. Using the standard ratio as above described, it is possible to determine quickly and easily day by day the efficiency of the handling and cleaning force. The men take great interest in this and insist upon knowing from their foreman how they are getting along.

An increase in the hourly rate was given at the inauguration of the plan. Since that time the men have earned a bonus varying from 2.2 per cent to 11 per cent each pay period. The gang now has only 11 men. The rest have been transferred to other jobs. Clerical costs instead of being greater under the plan are actually less.

With so many different items, most of them small, a large number of containers are required to hold the parts and scrap at the machines and work benches. Before the inauguration of the incentive there was always a shortage of containers. Now there is a surplus. Scrap containers are better utilized. Containers are placed at the benches and presses where scrap is produced, and the productive workers are required to discard into the appropriate containers according to the material, saving later separation costs.

Saving Scrap Costs

With bonus money in prospect, the members of the handling and cleaning gang are quick to call any failure of productive workers in this respect to the attention of their own foreman, because the separation of these scrap materials would act to decrease their efficiency and chance of bonus. Productive workers find scrap containers conveniently placed and sufficient for their needs without any effort of their own or any attention on the part of their foremen.

Short cuts in handling and cleaning are frequently found by the men. Instead of the trucker riding the elevator, in moving material from one floor to another, he places the material conveniently for the elevator operator to load. When unloaded on the right floor, another member of the gang located on that floor at that particular time completes the delivery.

Lowered Loading Time

Loading a car with 60,000 lb. of baled copper scrap, which formerly required the time of 5 men for 1 day, now takes 4 men from 3 to 4 hours. The number of times each bale was handled was reduced by using a wheelbarrow instead of a platform lift truck. Without an incentive it was of no interest to the men how long it took to load the car, but now that they have a community of interests, the men readily and voluntarily help each other out. And when a specific task is done, they move elsewhere as need arises.

So far this incentive plan has been satisfactory to all concerned. The men have been given something to work for. They enjoy higher earnings, take an increased interest in their work. And the company gets better service at reduced cost.

Gaskets, gaskets, gaskets . . . this plant manufactures some 20,000 items varying in size from 42 to 3-16 in. in diameter. Materials include aluminum, copper, brass, monel metal, stainless steel, asbestos. Byproduct of the incentive plan for handlers and sweepers is the saving in cost of segregating scrap

Jobs Keep Pace

TO REACH the 1929 per capita volume of production in the manufacturing industries, with the average 1936 work week, would require approximately 1,604,000 more wage earners than the average number employed in the first eleven months of 1936, according to the National Industrial Conference Board.

The labor requirement in 1929 was 8,767,000 wage earners, working 48.3 hours per week. In 1936 it was 7,630,000 wage earners, working 38.9 hours. To reach the total 1929 production, with the 1936 work week, would have required 8,738,000 wage earners, or an increase of approximately 1,108,000 wage earners over the 1936 working force.

Production in manufacturing industry would have to reach 105.7 per cent of the 1929 level in order to equal, on a per capita basis, the output of 1929. This volume of production in 1936 would have required 9,234,000 wage earners.

That employment has been keeping pace with production is indicated by the fact that the number of workers in the first eleven months of 1936 was 87 per cent of the average number employed in 1929, while the volume of production was 87.3 per cent of the 1929 level.

Overhead by Formula

The method of applying overhead plays a great part in determining cost. Here are three ways to do it, which emphasize the importance of reducing a business problem to a formula

B. F. MECHLING
Executive Vice-President, Nice Ball Bearing Company
Philadelphia

SCIENTIFIC management of a competitive manufacturing business requires first of all a proper analysis of the elements involved. The accountant has certain rules and regulations which are more or less fixed and recognized as good accounting. The average business executive takes the accountant's figures and weighs them in the balance to determine whether or not his business is profitable. If it is not as profitable as he would like to see it, he usually concentrates on reduction in cost of productive labor and scans the overhead to determine what to cut out.

All these things are important and play a great part in the matter of cost, but the plant executive who has had an engineering training not only looks at these items but also, in order to make a proper diagnosis of the case, reduces his problem to a formula and sets up an equation which is very apt to give him a new answer that may be just what is required. This is the subject I wish to discuss here with the hope that it will shed a new light on scientific management of business. The subject is too broad and has too many ramifications to treat all of them, so I shall confine my thoughts to a competitive manufacturing business and endeavor to point out the necessity of reducing all business problems to a mathematical formula.

Three Formulas for Overhead

The three accepted methods of accounting for the distribution of overhead can be expressed in the following formulas:

1. Productive labor + material + overhead in terms of percentage of the addition of these two elements = total cost.

2. Productive labor + material + overhead calculated on percentage of productive labor = total cost.

3. Productive labor + material + manufacturing overhead in terms of percentage of productive labor = manufacturing cost. Manufacturing cost + selling and administrative expense expressed in percentage of manufacturing cost = total cost.

It can readily be seen, and is generally admitted, that all three formulas are considered good accounting in some particular case.

Reduced to Figures

Let us reduce these three formulas to actual figures of a small manufacturing business doing between $300,000 and $400,000 per year. Let us assume that the productive labor of this business is $100,000, that the material purchased to be used in manufacturing is $100,000, and that the overhead is divided into two parts, $50,000 for manufacturing overhead and $50,000 for selling and administrative overhead. Total cost of doing business would therefore be $300,000 a year, and anything beyond this amount of total income would be profit.

Let us assume that this concern is pricing a small sale amounting to $4; the cost of productive labor is $1, and the cost of material is $1. Let us select the three general formulas and see what results we get:

Formula 1: $1 + $1 + 50% of total = $3
Formula 2: $1 + $1 + 100% of productive labor = $3
Formula 3: $1 + $1 + 50% of productive labor = $2.50 manufacturing cost + 20% of manufacturing cost = $3.

In other words, if this were the case, the profit would be $1 and the cost $3 regardless of which method was selected in applying overhead.

Now let us apply these three formulas to an article in which the productive labor is $1; material, 50c:

Formula 1: $1 + 50c + 50% of total = $2.25
Formula 2: $1 + 50c + 100% of productive labor = $2.50
Formula 3: $1 + 50c + 50% of productive labor = $2 manufacturing cost + 20% of manufacturing cost = $2.40

Then let us apply these three formulas to an article in which the productive labor is 50c and the material $1. This would give the following results:

Formula 1: 50c + $1 + 50% of total = $2.25
Formula 2: 50c + $1 + 100% of productive labor = $2
Formula 3: 50c + $1 + 50% of productive labor = $1.75 manufacturing cost + 20% of manufacturing cost = $2.10

Method Affects Cost

It can readily be seen from the above simple equations that the method of applying overhead plays a great part in determining cost. The problem is for the manufacturer to select a method of determining cost and applying overhead that will best suit his condition of competition and price his goods accordingly.

It is very evident that all three formulas, if used consistently, will take care of all overhead, but one formula cannot be used in one particular case of pricing goods and another formula at another time. This would upset all calculations and would not result in a complete application of all overhead during a

(Continued on page 92)

Our Production Planning Begins at the Shipping Door

Designed to fit a plant that makes 3,000 different parts—all of which have short manufacturing intervals and relatively short runs—this control plan works from the shipping schedule backward

A. R. KELSO and E. L. SHEEHY
Factory Manager Planning Engineer
Motor Products Corporation, Detroit

PLANNING for the output of 2,000 high production items and more than 1,000 miscellaneous parts, 85 per cent of which may be running through the plant simultaneously, presents a real problem in management control. The period of delivery time covered by orders received from customers varies from one week to three months. Parts vary in size, finish, and number of operations required to produce them. Large stampings and other bulky parts require large amounts of floor space, even with the maintenance of small banks of in-process work.

Too Much Detail

The centralized plan formerly in use scheduled from the central office. It required so much detail in posting to records that jobs were frequently shipped before the records were completely posted. This slow-acting plan was then discarded in favor of a large number of stockchasers. Getting the work through the plant was left up to them. The difficulty was that the foreman was informed orally as to order sequence. As a result, an order for bulky parts would be completed only to stand around in the shop waiting for a shipping release, while shipments to another customer might be delayed through congestion at some common equipment. The chief fault, however, was that the foreman had nothing to guide him in planning his man power or equipment load. There was practically no coordination between departments in balancing operations, and so the better stockchasers got their items through first at the sacrifice of others that might be more urgently needed.

All these difficulties were corrected by the adoption of methods to insure the accuracy of production records, coupled with a mandatory order that all foremen work to a definite parts schedule. Fourteen people are required in the planning department to take care of two shifts, and no one is on duty during the second shift.

The initiating move in this planning scheme is the purchase order from the customer. On the basis of this information the sales contact division draws up the *shipping schedule* (Figure 1). As parts are shipped, copy of the *bill of lading* is returned to the planning department where the quantity shipped is entered on the shipping schedule, thus revealing the balance yet remaining on order and on schedule. This move is important in forming a basis for the *departmental schedule* (Figure 2). Planning thus begins at the shipping door and works backward.

The shop works on two different pieces of information—the *departmental schedule* and *the departmental order* (Figure 3). The first is issued to every department concerned in the manufacture of a given part. The second is sent to the raw stock and primary departments only. The schedules are issued by the stockchasers and the orders by the control planning office.

It might seem that the schedule would be sufficient authority for the foreman to begin fabrication, but then inaccuracies in production records must be taken into account. Incorrect information resulting from wrong posting of part numbers may result in failure to fabricate, or the fabrication of too many of one part and too few of another. By permitting the primary department to function only when two pieces of information, issued by different divisions of the planning department, coincide, accuracy is insured. Raw stock will not be issued without an order, and if the initiating foreman does not have a copy of the same order to match his copy of the schedule, the discrepancy must be corrected before a move is made.

With the reservations made as to the initiating or primary departments, the *departmental schedule* is the authority of the foreman to manufacture. One is made for each department and states the part numbers and quantities to be made each working day of the week. It is based upon two sources of information. The first is the balance showing on the *shipping schedule*. The second is an end-of-the-week count of the parts in each department. Except toward the end of an order, this count is not an exact one, but affords a close approximation of the parts in process. This quantity found to exist in the processing departments is then balanced against what the shipping schedule shows yet to be delivered. Parts balances thus shown become the next week's production schedule.

Up to the Stockchasers

Stockchasers issue this *departmental schedule* for the parts coming under their responsibility. A copy is issued to the planning office and typed for the foreman, and upon it he posts the parts completed and moved out of his department. In three large primary departments this is done by clerks.

Seven stockchasers are required for two shifts. The 3,000 parts manufactured are divided among them by customers, and it is their responsibility to see that these parts are fabricated in accordance with the *shipping schedule*.

The stockchaser is held jointly responsible with the foreman to see that the schedule is maintained, and he must report to the planning head on all production interferences or impediments.

Even though the materials handling department is responsible to a separate supervisor in the planning department, the stockchasers must see to it that materials move to the subsequent manufacturing operations when ready.

Schedule changes are frequent, but cause no especial difficulty. The *schedule change notice* (Figure 4) passes through the same hands that established the original schedule. The sales contact division issues a new shipping schedule, the stockchaser issues a *schedule change notice* to the foreman, who in turn revises the figures shown on his departmental schedule. The *shipping schedule* in the planning department, on which quantities shipped are entered, must also be revised.

The foregoing constitutes the main outline of a plan that has proved its worth in a plant turning out a multiplicity of parts, all of which have a short manufacturing interval with a high changeover frequency. The process float maintained between departments is usually small, less than half a day in most cases.

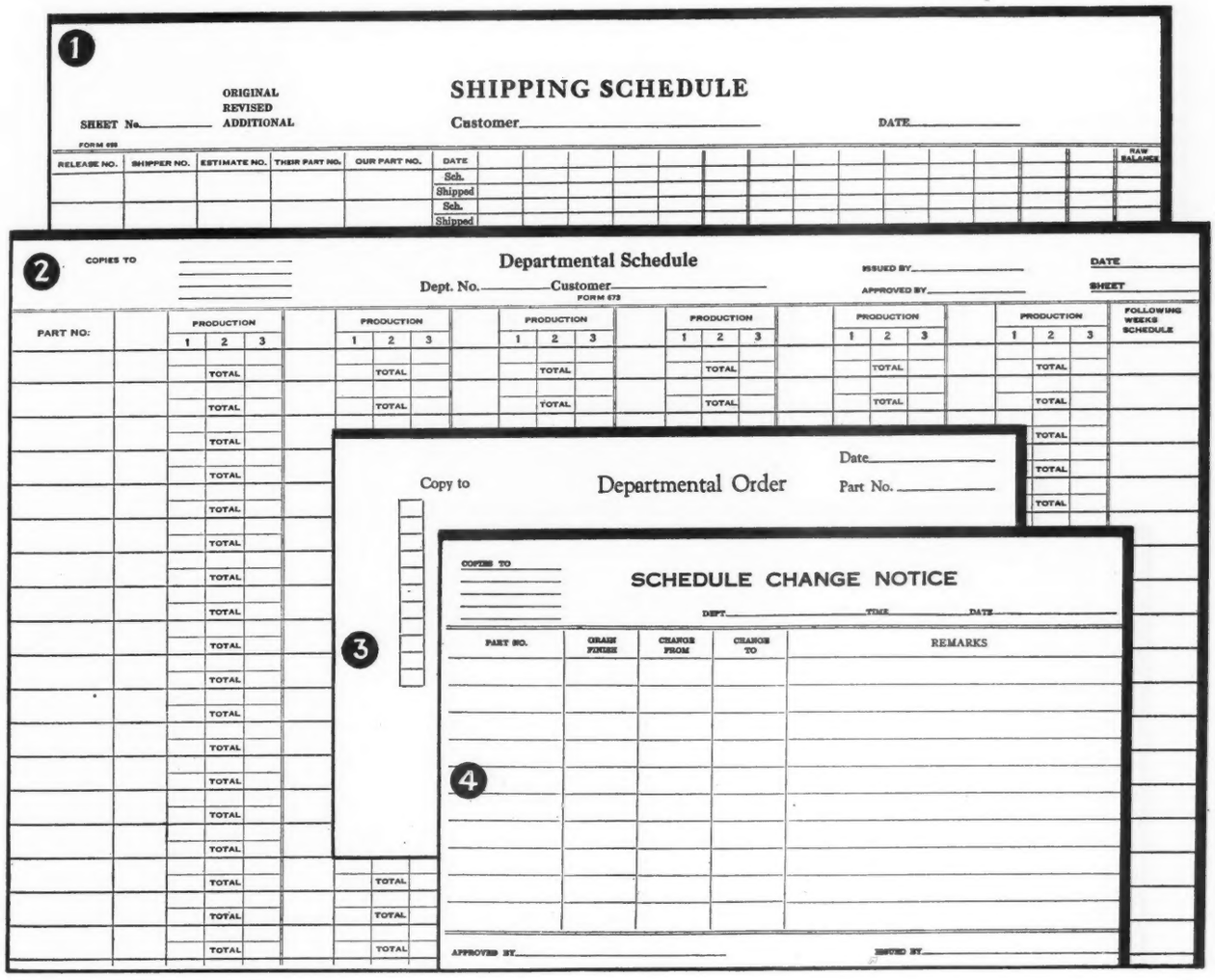
If Parts Get Behind

For reasons familiar to any production man, parts get behind schedule. On such parts a record is kept by having a member of the planning department check the choke points hourly and record production on a chart board in the department. Items that receive this special attention are selected from a daily summation of the *departmental schedules* showing the load against what the foreman has sent out of his department.

The purchasing department receives a copy of the sales order and a requirement schedule from planning, which indicates when the material is wanted. Steel purchase orders are based upon this, but schedule changes and difficulties in securing delivery make necessary a daily steel shortage list issued by the stockkeeper.

As a coordinating device, daily production meetings are held for the consideration of items behind schedule, progress of tooling for engineering changes and new tools for new jobs, equipment purchase and layout, rejections made by customers, and other items of similar nature. These meetings are attended by the factory manager, tool engineer, superintendent, production engineer, planning head, chief inspector, and the foreman of the three major departments.

In addition to this daily production meeting, the seven stockchasers meet weekly to insure that engineering changes are being properly considered in the issuing of their schedules and that material is being properly fabricated in accordance with the change instructions.



You want to know

and the editors will gladly tell you more about the things mentioned on this page

• TO SAVE your drawings from mutilation a little machine tapes the edges with paper or transparent tape. Sheets from tissue to 1/16-in. thickness are fed through the rollers while a small hand crank is turned. (3701)

• WOODS, marbles, hand-made designs can be reproduced in natural colors on plywood, asbestos, fabrics, composition board by a photographic process. Heat and pressure impress the designs into the surface so that they will not wear off. (3702)

• PROPER LIGHTING for the office is outlined in a booklet which lists recommended illumination standards for various office tasks, describes types of lighting equipment, and gives tips on how to make improvements. (3703)

• RUBBER PAINT in colors can be applied to etched and sandblasted metals, concrete, brick, and other surfaces. It's said to be immune to caustics and resistant to acids. (3704)

• EVERY smart manufacturer believes in the principle of more for the money. A booklet aims toward a working understanding of that principle in summarizing the four now famous Brookings reports. (3705)

• CORROSION-INHIBITING coating for galvanized, zinc alloy, and cadmium surfaces as well as for ferrous metal surfaces is highly adherent and is said to form an ideal base for any paint finish. It's applied by dipping. (3706)

• MOVIES in three dimensions and full color are something to put on your list of things to see next time you're in New York. They show valve manufacture. (3707)

• FACTORY EMPLOYMENT is going to be affected by the corporate surplus tax says a booklet. The authors offer two interesting amendments to the tax act. (3708)

• LESS CLEANING, reduced danger of spontaneous combustion are the benefits of an oil-spraying process for controlling coal dust. (3709)

• SHIPPING GUIDE, 1,350 pages long, gives comparative rail, truck, express, and parcel post rates from 109 key points in the United States to thousands of destinations. (3710)

• CHEMICAL, soluble in hot water, cleans metal, won't tarnish it. Can be used in tanks where electric current is flowing. (3711)

• ACIDPROOF GARMENTS for workers in chemical plants or around corrosive and poisonous substances. Dip coating of special rubber latex is applied to exterior of overalls, dungarees, gloves, etc. Only outside of garment is affected. (3712)

• FOR ENAMELERS — a pocket dictionary of porcelain enameling terms. (3713)

• TWO BOOKLETS prepared by the Social Security Board tell in question and answer form what you should know about unemployment compensation and old age benefits. (3714)

• SHOWER BATH FLOOR, solid rubber, makes possible employee showers without fear of dripping ceilings. It has a non-skid tread, and is laid with a 6-in. turn-up making waterproof connection with wall tiles. (3715)

IF, as the poet said, a thing of beauty is a joy forever, owners of this test meter are going to get a great deal of satisfaction in addition to that derived from its utility. Its neat-appearing case is aluminum. There are two types, one in five current ranges, the other in three. All moving parts of the register operate on jewel bearings. (3730)

• BOLT that's said to be good substitute for a rivet has longitudinal ribs that bite into sides of plate holes. Only tools needed are a hammer or sledge to drive it and a wrench to tighten its special locking nut. (3716)

• SMART EXAMPLE of combining appeal to two consumer interests in one product is a set of poker chips designed for bridge players. (3717)

• WANT TO SEE how commutators are made? Picture folder shows how one manufacturer does it. (3718)

• BURNERS of pulverized coal should be interested in tables of grindabilites and analyses of many coals of United States and other countries. (3719)

• METAL SPRAYING is constantly finding wider fields of use. A 36-page booklet contains a photographic story of the process. (3720)

• STEEL, free machining, can be drawn into knot and pulled tight without fracturing. Of high tensile strength and ductility, it can be cold formed, crimped, rolled. (3721)

• HANDBOOK on contour sawing shows more ways of cutting up than we could think of. There's a section on filing too. (3722)

• CEMENT simplifies preparation of polishing wheels. No heat is required in its application, and special thinner makes possible any desired thinning so that wheels of varying densities can be uniformly surfaced. (3723)

• JUMPING onto the swiftly moving bandwagon of better design and styling is a rubber electric cord plug which has gone streamline. (3724)

• NEW LINE of dehydrating cabinets dries air by chemical means for air conditioning installations. Air passes first through a dehydrating solution, then through a solid material that completes the job. (3725)

• EMPLOYERS are going to need a copy of the regulations on the excise tax imposed on them in connection with unemployment compensation. (3726)

• IF you have too much end play in a shaft there's a thrust washer designed for the purpose. To install it, all you need is a ball peen hammer. (3727)

• CAN OPENER of heavy duty proportions handles paint, oil, and carbide cans, lets you get that last drop or granule. It rolls cut edges into rounded, accident-proof rim. (3728)

• ROLL magnetism out of presses and other power tools. Not literally, of course, but that's what it seems is done when new demagnetizer is used that has a 5½-in. cylinder which operator rolls back and forth. Inside the cylinder are the vital parts that really do the job. (3729)

To Keep Electronic Devices Operating

A little attention intelligently directed toward places that need it is more effective than a great deal of haphazard tinkering

H. C. JENKS
Control Engineering Department
Westinghouse Electric & Manufacturing Company
East Pittsburgh, Pa.

EARLY applications of electronic devices in industry were merely adaptations of radio apparatus and circuits to a duty that was different from that for which they had been developed. Consequently the apparatus was not always successful in performing the service expected of it. Now, in addition to the use of more judgment and care in the application of these devices, great improvement has been made in their construction.

Follow Instructions

In many instances, however, the advancement in the design and manufacture of electronic devices is more or less offset by the lack of training and knowledge on the part of maintenance men who take care of the equipment. That situation can, and doubtless will, be remedied.

Assuming that the equipment is suited to the application, it should be installed strictly in accordance with the manufacturer's directions. Locate it in a place that is dry, of reasonable average temperature, and as free as possible from dust, dirt, and excessive vibration.

It is imperative that adjustments be made strictly according to the instructions.

The apparatus should be connected to supply lines of the correct voltage and frequency, and of such stability that both of these remain as nearly constant as possible. Most manufacturers specify that the voltage should remain within 5 per cent, plus or minus, of its nominal value. This limit should be adhered to as closely as conditions permit.

With installations that utilize light, the filament voltage has an important bearing on the amount of light emitted by the light source, and may be of major importance in the proper performance of equipment that operates at a high level of sensitivity. Focus, proper position of apertures, rigidity, and correct installation of the light-sensitive devices are important.

Voltages Must Be Right

Examine tubes before installation and at intervals thereafter to make sure that no connections are loose or corroded.

It is imperative that tubes be operated at the proper anode, cathode, and grid potentials. Too-high cathode voltage results in short life from rapid deterioration of the cathode; undervoltage may also result in short life due to the bombarding of the cathode by the current drawn from the anode. Anode and grid voltages are also of major importance, since the characteristics of the tubes and their function in the circuit may require that these voltages be maintained within definitely prescribed limits.

The ambient temperature in which the tubes are operated may be of considerable importance, particularly with tubes that contain certain gases, such as mercury vapor. Performance of these tubes is affected by the condensed mercury vapor temperature, usually measured by reading the temperature of the bulb just above the base of the tube. These tubes probably will not operate successfully at temperatures below 20 deg. C., or above 50 to 60 deg. Centigrade.

Other types of gaseous tubes are not so definitely affected by temperature, and frequently are supplied when it is known that wide ranges are likely to be encountered.

Many industrial tubes in use have cathodes of considerable mass in order to obtain sufficient emitting surface. To avoid bombarding of the cathode by current from the anode it is important that no anode current be applied until the cathode has reached its operating temperature. Relays are often provided to meet this requirement.

Inspect Periodically

A complete set of spare tubes should be carried in stock. Whenever possible, inspect and test tubes on a definite schedule. If testing facilities are not available, and the value of the tubes is sufficiently high, most suppliers will be willing to make the necessary tests.

Much could be said concerning the inspection of the various parts comprising an electronic device. It is important to bear in mind, however, that careless or haphazard efforts to do maintenance work or remove dust and dirt are almost as likely to cause trouble as entire absence of maintenance.

For example, certain types of resistors used with electronic equipment have extremely high resistance and are sometimes necessarily of light construction. In wire-wound resistors of high resistance value the wire is very fine and readily damaged. When there is trouble it is important to observe whether the

resistors are open-circuited, short-circuited, or grounded.

If these resistors are adjustable it is well to check the setting against the manufacturer's instructions.

Condensers normally do not require maintenance, unless they become shorted or grounded because of abnormally high voltage. The surfaces of the condensers should, however, be kept free from dust.

Potentiometers are subject to the same influences as resistors, with the added likelihood of a change in the setting caused by accident, meddlers, or excessive vibration. However, repairs or adjustments can readily be made.

It is recommended that the resistance to ground of the leads used in electronic devices be on the order of 50 megohms or more. In some instances the capacity between certain leads or to ground may adversely affect the performance, if the length is too great. Usually the manufacturer will indicate the maximum length of leads when this factor is important.

Resistances Are Important

In some instances special cables are required to reduce the capacity or resistance to ground, or it may be necessary to run certain leads through grounded conduits.

In certain applications, particularly where phototubes are involved, it is important to have high resistance between leads. Under high humidity absorption of moisture by the cotton insulation applied around leads has been sufficient to prevent proper operation. If this seems far-fetched, consider that in some extremely sensitive circuits the resistances of the phototube and grid paths may be 30 megohms or more; therefore, shorting of terminals by the cotton on the connecting leads may readily change the resistance enough to ruin operation.

Examine tube sockets periodically for loose or corroded contacts. Faulty operation has occasionally been found to be due to poorly soldered contacts, or so-called "rosin joints." These are the result of hurried soldering whereby a thin film of rosin is formed that prevents metal-to-metal contact.

Maintenance Pointers

If the resistance to ground remains high, the wiring in electronic devices should require no more attention than does other control wiring. Rosin joints, loose connections, blown fuses, grounded terminals, and defective insulation should receive the same attention that would be given to other types of control equipment.

Drum-type contacts used in certain electronic applications are in continuous operation, and should be maintained very carefully. Keep the contacts that rub on the drum clean, and the drum surface smooth, to avoid abrasive action. Rapid wear of carbon brushes results in deposits on the inside of the switch that may give trouble. Blow out the switch periodically with compressed air. Check the resistance between segments to make sure that it is of high ohmic value. Resistance from the metallic conducting surfaces to ground must also be kept high.

Mechanical contacts require the same maintenance as drum contacts. Keep them clean, and the resistance to ground and to other parts high. It is particularly important that the proper gap be maintained between the moving and stationary parts.

Magnetically operated contactors should be non-bouncing, non-sticking, and free from excessive friction. Arcing at the contact tips should be kept to a minimum, to promote long life.

Coils should be checked for voltage and current applied, overheating and, in case of failure, for open or short circuits.

Frequently manufacturers are called in for troubles that are really of minor character and could have readily been diagnosed if the proper instruments had been used. The special equipment required for testing electronic devices is not large in amount, and differs from the ordinary types only in being more sensitive and having higher resistance.

Meters for Troubleshooting

The usual voltmeter ranges required are from zero to 5 volts minimum, to zero to 1,000 volts, maximum, both direct and alternating current, the resistance per volt being on the order of 1,000 ohms or higher. Current-reading devices are needed in capacities of zero to 1 milliamp., zero to 10 milliamp., zero to 1 or 5 amp., both alternating and direct current, and above these values whatever capacity the normal operating requirements of the circuits may dictate.

It is important to have a resistance meter reading from zero to between 1 and 10 megohms. For higher resistances, such as between wires and ground, an insulation resistance meter may be employed.

Mechanical elements of the equipment to which electronic devices are applied should be properly adjusted, lubricated, and as free as possible from lost motion. Faulty operation of a unit is often blamed on the electronic device when actually the mechanical portions of the equipment are the cause of unsatisfactory performance.

These instruments are needed to test electronic devices under all conditions. Beginning at the left there are shown; 0 to 1 and 0 to 5, double-scale, d.c. ammeter; 0 to 1 a.c. ammeter; an insulation resistance meter; a combination multi-range instrument indicating ohms, milliamperes and volts, a.c. and d.c.; 0 to 5 a.c. ammeter; 0 to 10 a.c. milliammeter

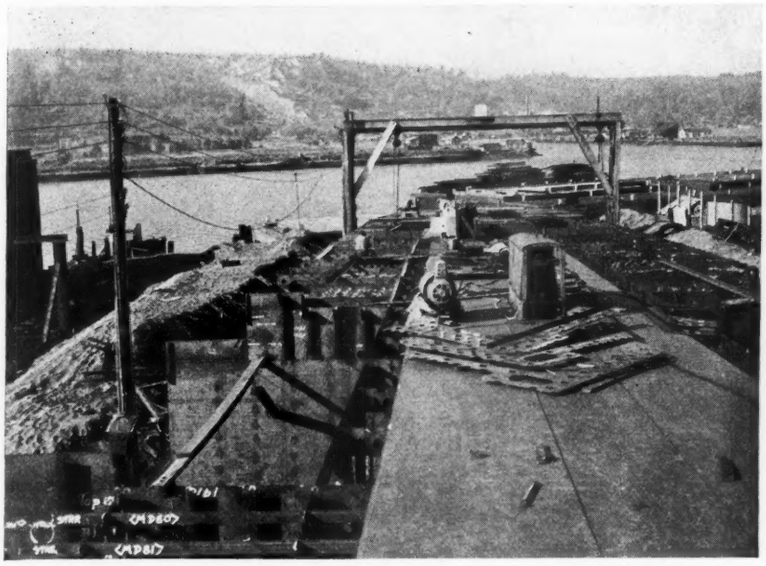


FIGURE 1. Partly assembled boat, viewed from bow end. Plate and decks are only temporary. About 10 tons of welding rod was used on some 300 tons of steel assembly. Batteries of as many as 30 arc welders were used. One of several portable gasoline-dynamo units can be seen in the center. Much of the welding of plates on ribs and other joined members was done in the plant of the Western Engineering Corporation, Seattle, before erection of main frames and plates was begun on the shipways. Assembly was temporarily secured by tacking with arc welds. Permanent welding was done at night, assembly usually by day. Steel sheets of 1/4 to 1/2 in. were used in the "skin." In the frame and beams the average is about 5/16 in., and in the general hull assembly, 5/32 to 7/32

Lighter, Stronger by Welding

No bolts or rivets in any part of the plate, hull, or frame of Inland Steel Company's all-steel towboat. Welding makes it much stronger than vessels of like size, permits a weight saving of 5 per cent

GUSTAV KOBROW
Naval Architect, Inland Steel Navigation Company, Seattle

FIGURE 2. The overhead weld was the most troublesome to perfect. However, buckling and permanently bad alignment were entirely avoided by careful distribution of heat and by applying a jack close to the heated area to help counteract buckling strain. As a result, the flat-bottomed boat is truly flat-bottomed

FIGURE 3. Downwelding of boat "skin" from the inside. The downweld (bearing arc on a horizontal weld in a horizontal plane) is less difficult than the transverse, much less difficult than the overhead weld

60 Foot-Candles Mean Real Seeing

J. F. ANDREWS
Assistant Editor

Business is good at Oshkosh B'Gosh. And getting better. But production peaks bring production problems, and too many mistakes is one of them. Modernized lighting was the answer in this overall plant

LIKE a lot of other plants, the Oshkosh B'Gosh Overall Company of Oshkosh, Wis., found that it had to gear itself for definite production increases this year. More efficiency and less waste were in order for all departments.

In this program, modernized lighting for the denim cutting rooms played a major role. The work there consists of "laying up" material on cutting tables, marking it, and cutting. Forty-eight lengths of denim of 60 yd. each are piled double on the cutting tables. It is important that the cloth be stacked evenly and straight, because any irregularity would affect the fit of the completed overalls. The edges of the cloth

"Before-and-after" views of one of the cutting rooms. The old lighting installation, providing from 4 to 7-foot candles, was hard on the eyes. Despite the low intensity, glare and excessive contrast between light sources and surroundings gave the sensation of too much light. The new installation, eight 300-watt units per table, provides from 55 to 60-foot candles without glare and with a minimum of shadows. Errors have been reduced. Eye-strain has been eliminated

must be free of shadows for accurate stacking, and stenciled patterns must be clearly discernible. Errors are multiplied because material for 60 overalls is stacked and cut at one time.

After the material has been cut, the various pieces are rolled together in bundles, tied, and marked. These cuts are matched and distributed in the sewing room so that each part of an overall is taken from the same piece of denim to make sure of the same color and shade throughout.

All this requires exceptional seeing conditions. Good practice recommends 50 foot-candles or more. The installation here described provides from 55 to 60 foot-candles on the working plane.

General overhead lighting was chosen in preference to local plus general in order to prevent shadows and differences in intensities. As it has turned out, the variation is less than 6 foot-candles.

There are eight 300-watt lighting units for each cutting table. Fixtures are of the prismatic-glass type. Two pull-type chain switches are provided for each table, each switch controlling a bank of four lights.

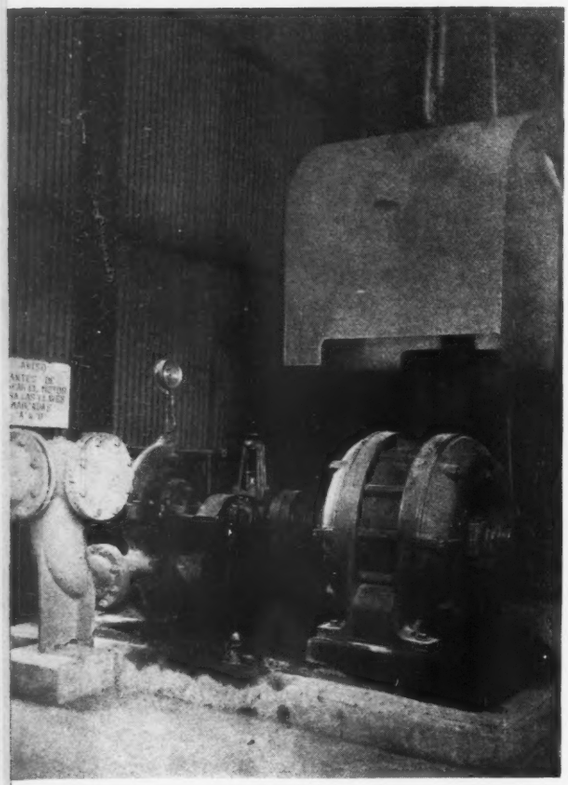
Shadowless Light

To prevent shadows on the lining-up edge of the table, the fixtures are located in a line over each table just inside a perpendicular to this edge. They are mounted 7 ft. above the working plane, on 10-ft. centers along the table, with the first outlet just above the end of the table. This gives a spacing of approximately 1½ times the mounting height in one direction, and approximately the mounting height in the other. A nearly shadowless light is provided for the cutter and stenciler, both of whom bend over their work to such an extent as to make any light source directly overhead practically useless.

In spite of the increased intensity (it is approximately eight times as much as before), thus illumination is shadowless and glareless. It produces no discomfort. At no time do rays from an exposed source strike the eye at an angle less than 45 deg. from the horizontal. Operators are far less fatigued at the end of the day in spite of the fact that the factory is at its operating peak and the men are working at top speed all the time.

There are other tangible benefits. Costly mistakes are infrequent. Accidents have been reduced. Labor turnover and training costs have been cut because employees are satisfied with working conditions, and because a better class of employees is attracted to the plant. General supervision is improved because less time is needed for specific instruction of new employees.

Strip Heaters Keep Their Fire Pump Motors Dry



Cuban concern cures tendency to absorb moisture, insures prompt starting, by installing light metal covers and strip heaters

E. MOLINET
Electrical Engineer
The Cuban-American Sugar Company
Delicias, Oriente, Cuba

FOUR centrifugal fire pumps driven by motors of 100- to 150-hp. rating are located at various stations to serve certain areas of our mill. These pumps are operated and inspected once a week to make sure that they are in good condition, but our experience with failures of motors that run only occasionally has led us to take additional measures to prevent trouble with these fire pump motors. Failure of a fire pump to start immediately and keep going as long as it is needed may mean disaster.

The principal cause of failure of motors that stand idle for long periods is due to the windings absorbing enough moisture to lower the insulation resistance to a fraction of its proper value. Then, when the motors are started, small leakage currents will flow to ground and between parts of the windings.

Leakage currents will be greatest at points where the insulation is weakest and will cause local heating, which further lowers the insulation resistance at that point. The effect is cumulative and would cause failure if it were not for the heat that is generated under load. It will tend to evaporate the moisture and restore the insulation resistance to practically its original value. However, permanently weak places in the insulation are created; if this cycle of conditions is repeated a number of times, grounds and short circuits will occur at starting.

A fire pump motor is subject to these conditions. If no preventive measures are taken, it may fail when it is urgently needed to fight a real fire in the mill.

Test Showed Effect of Moisture

To show the effect of moisture, the following test was made: A 125-hp. 440-volt fire pump motor was dried in an oven until the insulation resistance reached a maximum value of 30 megohms at 80 deg. C. The motor was then put back in service and run for 15 min. at full load at intervals of a week or so. Table I shows the results of measurements of the insulation resistance before and after the test runs. It will be seen that the insulation resistance of 0.4 megohm on May 22 is less than the minimum of 0.44 megohms required by the A.I.E.E. rules, at the operating temperature.

In order to restore the insulation resistance to its proper value, it would be necessary to dry out the motor again. This operation can be done by several methods, but we could not find a good answer to the question: Why not keep the motor dry at all times?

Accordingly, a light metal cover was made and placed over this motor. Underneath the motor frame a 200-watt strip heater was permanently installed and connected to the lighting circuit. As will be seen from the illustration, the cover is suspended from a rope, so that it can be lifted up quickly before starting the pump, in case of fire.

The temperature of the air inside the cover is about 120 deg. F. Current consumption of the strip heater is 144 kw.-hr. a month.

Table II shows the insulation resistance readings obtained on the motor after installing the heater.

Where power rates are high the current consumption of the heater can be reduced by thoroughly insulating the cover to reduce loss of heat, and controlling the temperature through a suitable thermostat.

It is planned to install strip heaters and covers for the other fire pump motors.

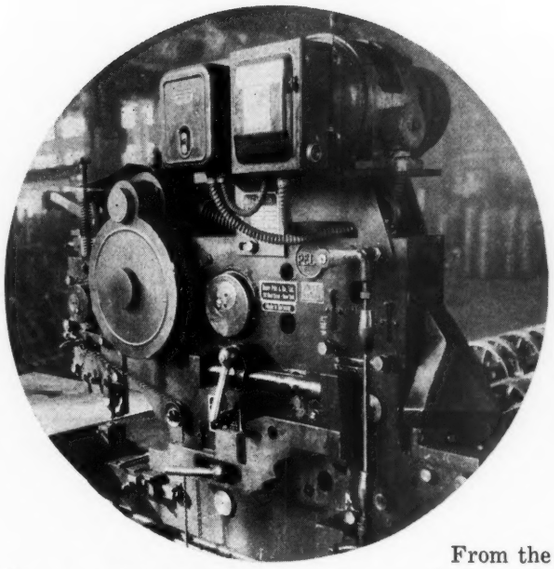
TABLE I
Insulation Resistance of Motor Before Installation of Heater

	Insulation Resistance, Megohms	
Date	*Before Starting*	*After Running 15 Min.*
April 18...	30	30
April 25...	10	2
May 4.....	5.5	1
May 9.....	7.5	1
May 22....	1.5	0.4
June 2....	0.6 (Dangerous)	0.2
June 12....	0.2 (Dangerous)	0.1
June 22....	0.15 (Dangerous)	0.05
June 29....	0.25 (Dangerous)	0.01
July 11....	0.15 (Dangerous)	0.05

Heater installed July 11

TABLE II

July 28....	3	1
Aug. 7....	1.5 (Wet weather)	0.6
Aug. 28....	3	1
Sept. 20...	5	1.5
Oct. 31....	5	1.5



New a.c. motors and controls are replacing d.c. equipment on practically all machines.

50 Per Cent Less for Power

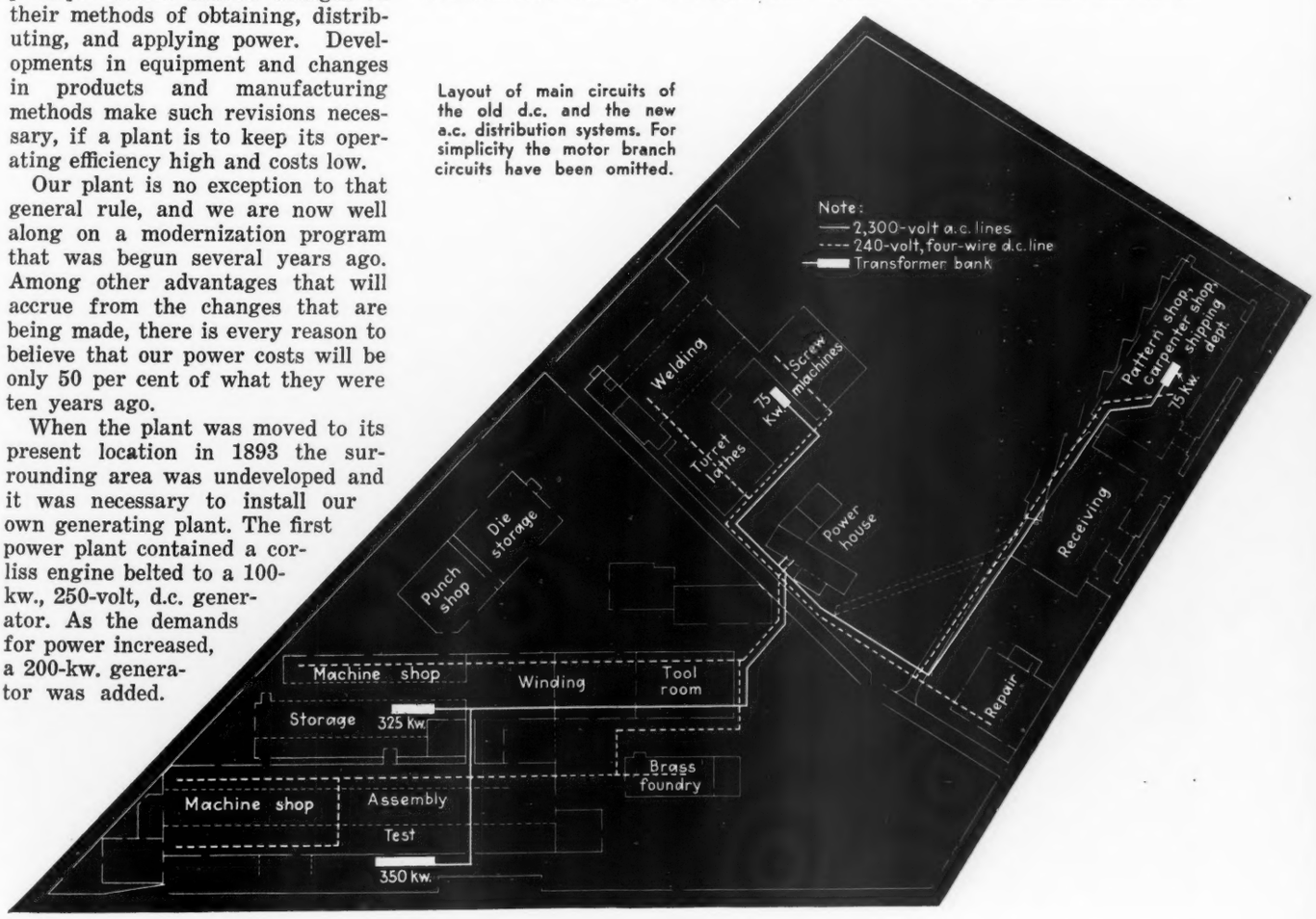
H. O. MAY and J. DIXON
Plant Engineer Construction Engineer
Crocker-Wheeler Electric Manufacturing Company, Ampere, N. J.

MOST industrial plants that have been operating for 50 years or so have had to make perhaps several radical changes in their methods of obtaining, distributing, and applying power. Developments in equipment and changes in products and manufacturing methods make such revisions necessary, if a plant is to keep its operating efficiency high and costs low.

Our plant is no exception to that general rule, and we are now well along on a modernization program that was begun several years ago. Among other advantages that will accrue from the changes that are being made, there is every reason to believe that our power costs will be only 50 per cent of what they were ten years ago.

When the plant was moved to its present location in 1893 the surrounding area was undeveloped and it was necessary to install our own generating plant. The first power plant contained a corliss engine belted to a 100-kw., 250-volt, d.c. generator. As the demands for power increased, a 200-kw. generator was added.

From the beginning practically all power tools have been driven by individual d.c. motors. At that time the a.c. motor was so new that much development work remained to be done. To provide the range in speeds necessary for driving machine tools, the four-wire, multi-voltage system was used. With this system shunt-wound motors are used and operated at full field strength. Under these conditions the speed is closely proportional to the voltage applied to the armature. Thus, if the system provides voltages of, say, 60, 120, 180, and 240, motor speeds of 25, 50, 75, and 100 per cent of rating can be obtained with good commutation and low losses. If intermediate speeds are required they can be ob-



Layout of main circuits of the old d.c. and the new a.c. distribution systems. For simplicity the motor branch circuits have been omitted.

tained by field control. The system we have been using provides six different voltages in steps of 40 volts. A costly and cumbersome, although comparatively simple wiring system is required for this method of speed control, but the efficiency is so high and the control of speed so close that this system has been used in a number of large shops.

When the manufacture of a.c. apparatus was begun in 1904 the matter of obtaining power at different voltages and frequencies, for testing, immediately came up. This question was solved by installing m.g. sets driven from the d.c. end at whatever speed was necessary.

Two Distribution Systems

Some years later increases in production raised the power demand beyond the capacity of the power plant. Therefore, an auxiliary supply was purchased from the utility company serving that area. This supply was delivered at 4,150 volts, two-phase, and stepped down to 2,300 volts to drive m.g. sets from the a.c. end.

Continued growth led to the installation of many new production machines driven by a.c. motors, which in time made it necessary to install a 220-volt, three-phase distribution system that practically paralleled the existing d.c. system. From time to time other and larger m.g. sets were installed to meet increased demands for d.c. power. In later years our engine-driven d.c. generators were operated chiefly during peak load periods and at night. In other words, most of our power was purchased.

The natural result of all these changes and additions was two rather complicated electrical distribution systems, one for alternating- and the other for direct-current power, at different voltages. With the low voltages carried by some lines the losses were serious, since the distances between buildings, and in some of them are considerable.

Following the practice established in the early days, all lines between the power house and the various buildings were carried on poles.

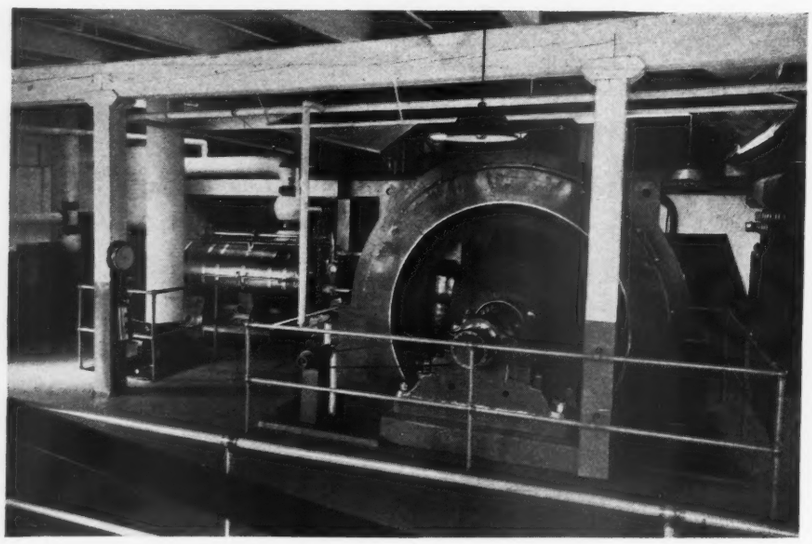
The situation in the power plant was just about as unsatisfactory during the past few years. When we first began to purchase power three 400-hp. water tube boilers were operated. Hand firing was employed and several men were required to handle coal and ashes and tend the boilers. Even when the engine-driven generators were operating at full capacity the exhaust steam produced was not sufficient to meet the requirements for building heating and process. As a result, a fairly large amount of live steam had to be used for these purposes, which increased the operating costs.

Changed to Oil

A change-over to oil firing about three years ago brought the boiler plant up to a high level of efficiency and reduced the cost of operation considerably. This was one of the first steps in our program of modernization.

It had long been obvious that drastic changes should be made in our methods of securing and distributing electrical energy. After a thorough study of our requirements, and consideration of different methods, it was decided to install a 750-kva., engine-driven, 2,300-volt, three-phase alternator. Two important factors were involved in our decision to install this unit, which will supply the major part of our power requirements. The first was the magnitude of the demand peaks, which were caused by the intermittent need for large amounts of power in testing large motors and generators, and when the production schedule required simultaneous operation of several pieces of equipment whose power requirements are high. The other consideration was the need for more exhaust steam for building and process heating. Now, with the new unit in operation, it is not necessary to use live steam.

An engine-driven, 2,300-volt, three-phase generator will supply most of the electrical energy required



A.C. Motors Replace D.C.

Another unit consisting of one 100-kw. d.c. generator and one 100-kva. alternator belt-driven by a single engine helps to carry peak loads and furnishes both a.c. and d.c. power at nights and over week-ends.

It was also decided to replace all of the 500 d.c. motors on machines that can be driven at constant speed with three-phase, a.c. motors; replace all overhead transmission lines with underground cable; and install a new a.c. distribution system for power and lighting in all buildings. Use of d.c. power will be confined to the cranes and a few machines that require a sufficiently wide range of speed to make it necessary to drive them with d.c. motors.

Power is now transmitted from the power plant to all buildings at 2,300 volts, and distributed within the buildings at 220 volts, three-phase. It has been possible to utilize a considerable portion of the old d.c. wiring for the new system. Much of it was run open, but has now been put in conduit. A ground plan of the plant, showing the layout of the old and new distribution systems is shown in one of the illustrations.

Since all of the changes described above have not been completed the full measure of economies that will result from them is not known. It is possible, however, to make a close estimate, based on certain facts. For example, the level of production in the plant in 1935 was approximately the same as in 1927, but the total cost of power for December, 1935, was 27 per cent less than for December, 1927. It is confidently expected, therefore, that when all of the changes have been completed the cost of power per unit of production will be 50 per cent less than in 1927.

Half the Steam per Pound of Product

WALTER E. HUME
Supervisor, American Hard Rubber Company
Butler, N. J.

LACK of personal responsibility is a large factor in the problem of controlling waste. A man who gets a gas or light bill that is 25c higher than he thinks it ought to be will insist that the meter is wrong. But when he gets out in the shop it is a different story. He doesn't have to pay for the light left burning at a machine. Unless the hot water from a leak in a steam pipe happens to drop on *him*, a steam leak is something for someone else to worry about. On a warm day in the spring or fall he leaves the heat on with the windows open.

It is difficult, in short, to visualize the necessity for small savings when the total amount of steam used may run over 100,000,000 lb. per year, but a statement that 30, 40, or 50 lb. of steam is required for each pound of product is easily understood.

Steam is the medium used to provide the necessary heat in the processing of rubber. We buy it in large quantities. Hence, when a check of steam consumption was made some five years ago and revealed wide variations in the amounts used per month, it was obvious that here was a wide-open opportunity to reduce manufacturing costs.

Yardstick Wanted

A mere statement, however, of how much steam was being required gave no information as to how much was being used and how much was being wasted.

First step, therefore, was to determine the ratio of pounds of steam required to pounds of rubber compound mixed. This ratio was chosen because all rubber compounds require steam for curing or vulcanizing.

Ratios for the thirteen pay months were then determined and are shown in the top curve of Figure 1. They illustrate the wide variation in consumption that has already been referred to. The maximum ratio was 210 lb. of steam to 1 lb. of compound during a cold month and in a period of decreased activity. Wide variations also occurred when neither heating load nor activity was a serious factor.

All this led us to ask ourselves whether we could not set up a control curve indicating what the monthly ratio should be.

During 1933, therefore, a campaign to reduce waste was started, and average ratio of steam consumption was checked. A survey indicated possibilities of eliminating waste and adopting more effective ways of using steam, and for the summer months a ratio of 30 lb. of steam per pound of compound mixed was set up as a base, this figure being considerably lower than the monthly average that was actually found.

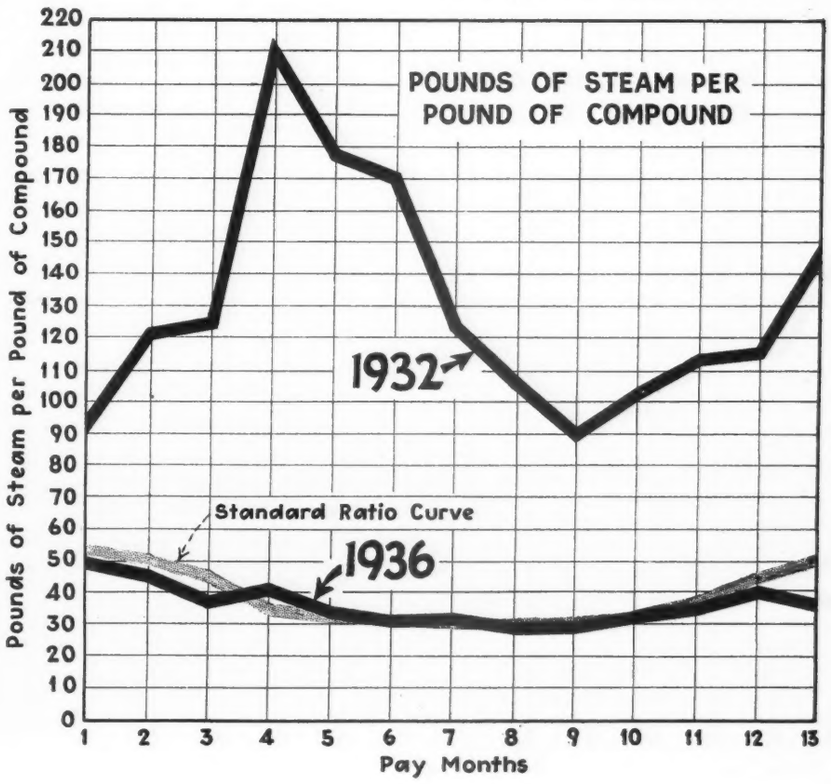
Next the monthly heating load was calculated and its ratio added to the base figure. The result was the standard ratio curve represented by the light gray line in Figure 1. Plotted for each pay month in the year, it shows an average of 36.6 lb. of steam to 1 lb. of compound mixed. With this curve as a control line—or a mark to shoot at—the real work of cutting down on waste began.

Reasons for increased steam costs may be classified under two headings — preventable wastes and methods of use.

Declared War on Waste

Preventable wastes include (1) lack of insulation, (2) poorly installed insulation, (3) leaky pipe

FIGURE 1. Maximum ratio of pounds of steam to pound of product was 210 to 1 for 1932. Average steam consumption for 1933 was 71.6 lb., dropped to 36 lb. in 1936. The curves show how closely actual steam consumption approaches the standard that was originally set up



threads, (4) leaky valves, (5) failure to detect and repair leaks, (6) waterlogging and air binding.

To prevent waste, a power saving committee was set up with the master mechanic as chairman. Systematic waste reports, made every day and every night, were instituted. A steam fitter was then assigned to follow up, make the repair, and report back when the waste was eliminated. A gradual substitution of welded for threaded joints followed, particularly where lines installed for many years needed replacement. Old and worn-out coverings were renewed. Contacts with the various departments brought about a more careful checking of valves left open unnecessarily, more prompt reporting of leaks. Steam saving was presented as a problem at a regular monthly foremen's meeting.

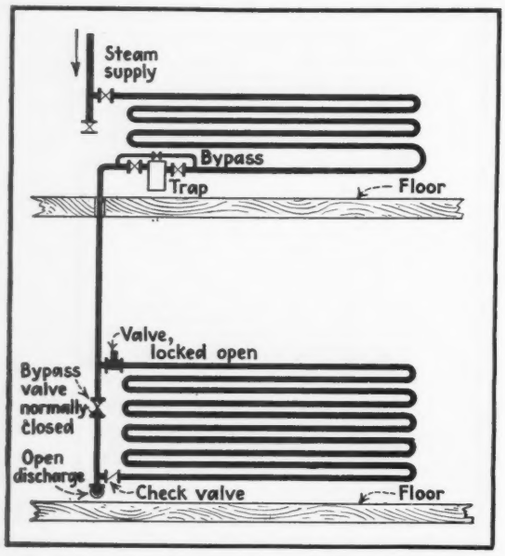


FIGURE 2. More effective use is made of process steam by locating hot water coils below steam coils. This foolproof arrangement (described in the text) prevents someone from shutting off the lower coil and thereby plugging up both steam coil above and hot water coil below

Exhaust Steam Largely Lost

Second, a way was found to make more effective use of exhaust steam. At our plant few of the processes make use of hot water. There is no feed water to be heated. This meant that exhaust steam from presses, driers, warming tables, and heating system had been largely lost. The heating system alone requires a total of about 19,000,000 lb. a year.

Here was an opportunity to save some of the exhaust steam. Where steam coils are located on upper floors, the trap discharge was connected to hot water coils located directly below in the shipping room, garage, comb washing, comb rubbing, inspection, grinding, and dust rooms. A typical arrangement is shown in Figure 2.

Care was taken to make the arrangement foolproof, to prevent someone from shutting off the lower coil and thereby plugging up both steam coil above and hot water coil below. The supply valve to the hot water coil is therefore locked in the open position. A valve that bypasses it is normally closed, forcing the hot water to circulate through the coil. If the bypass valve is then opened for any reason, the water is merely sent directly outdoors without in any way affecting the steam coil in the processing department.

As another source of saving, traps bleeding the steam mains have been connected to warming tables wherever possible.

Used an Injector

Another method of saving exhaust steam is illustrated in Figure 3. With effective circulation all parts of a circuit are supplied with steam at the same temperature and pressure. It involves a closed, continuous circuit and some means of imparting velocity to the body of steam apart from the velocity of the make-up steam. This purpose is accomplished by using an injector in the main inlet valve and by connecting the end of the return main to the suction side of the injector, which causes an induction of the return exhaust steam back again through the closed continuous circuit.

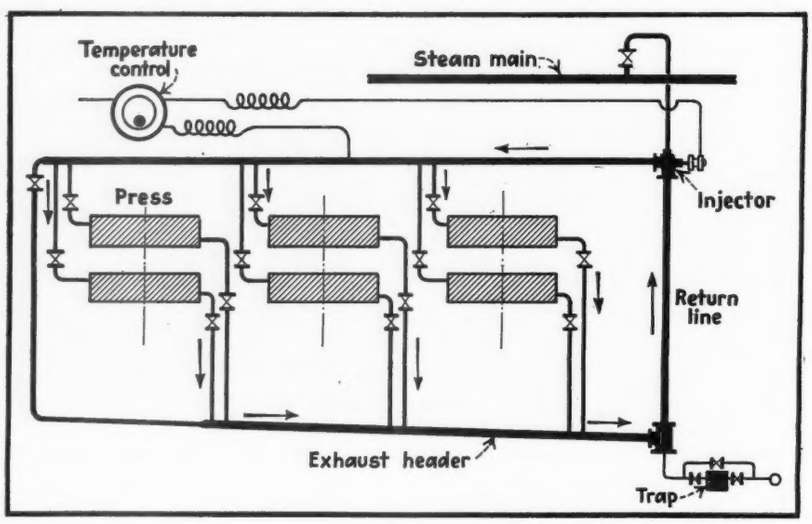
Figure 3 shows a typical application of this principle. It shows the location of the temperature control mechanism, the injector, and the return pipe connection to the bottom of the injector. The lowest point of the return header is connected to a single trap which drains the condensate while the steam in the exhaust header is drawn back up to the injector and recirculated. Principal advantages of the system are positive, continuous circulation through the presses and piping, and reduction of the live steam discharge to a minimum.

Steam Consumption Halved

Figure 1 illustrates the progress that has been made toward meeting the standard that was set up. Curves for all the intervening years have not been included for fear of complicating the chart. It will be enough, however, to state that the average steam consumption per pound of compound in 1933 was 71.6 lb., that it dropped to 47.4 in 1934, and to 40.6 in 1935. The curve for 1936, on the other hand, is given and shows how close to the original accumptions the ratios have worked out. Average consumption for 1936 was 36.0 lb. as compared with 36.6 originally set up as a standard.

The use of the control curve has been extremely useful in budgeting costs of service. For instance, if the forecasting of future business anticipates the processing of 200,000 or 300,000 lb. of material for a given period, the cost of steam can be determined within a few per cent of actual requirements.

FIGURE 3. Exhaust steam is recirculated by using an injector in the main inlet valve and connecting the end of the return main to the suction side of the injector



Operating Shorts

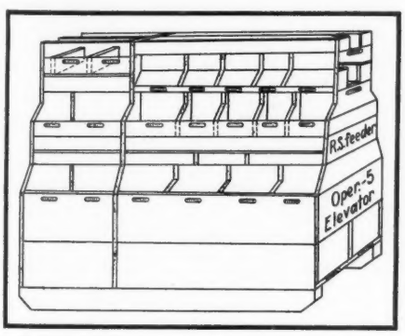
Cabinet Saves Time and Space, Eliminates Confusion

JAMES W. EMMONS, *Time Study Engineer, Dexter Folder Company Pearl River, N. Y.*

One of the most costly operations in our major assemblies used to be the time consumed in sorting and gathering the various parts together. For years it has been the custom to pick out the parts from a numerically arranged stock list in the stock room. The parts were then placed on a four-wheeled truck for delivery to the assembling location.

Under this procedure, the assemblyman was given the parts in their numerical order, but in a quite unrelated position for assembly.

To reduce the time consumed in hunting over a conglomeration of parts, cabinets were constructed as illustrated. They comprise a series of compartments of various sizes, each labeled with a zinc plate showing the part symbol and number. These compartments are arranged so that the parts can be placed in the order of use, and be easily accessible. Moreover, they are designed to make them serviceable for any of our various types and styles of machines, so that similar parts will fit into their proper section even though their shapes may vary.



The cabinets are thus very flexible and efficient units. Their uniform size and symmetrical appearance, in place of a mass of parts on trucks scattered throughout the plant, add to neatness and order. They can be moved without difficulty.

More floor space for production machines has been made available by the use of these cabinets, and a large number of trucks have been released for use in other parts of the shop. The greatest advantage, however, is the saving of time in assembly. This amounts to nearly 30 per cent.

Mr. Emmons's contribution has been awarded the $10 payment offered by the editors for the best Operating Short submitted during the past month.

Spoilage has been cut 50 per cent by jumping foot-candles from 12 to 30 in the wire-covering department of a large manufacturer.

How to Measure Static Torque of a Load

J. DIXON, *Construction Engineer Crocker-Wheeler Electric Manufacturing Company, Ampere, N. J.*

Determination of the motor horsepower required for a certain load is often necessary when suitable electrical measuring instruments are not available. The data required can easily be obtained, however, in other ways.

It is first necessary to measure the pull in pounds at some known radius in feet required to turn the driven shaft. The normal speed of this shaft must also be known. A long-handled pipe wrench will provide a convenient means of turning the shaft, which should be fully loaded. That is, clutches should be in, belts placed on tight pulleys and so on, so that the entire load will be measured.

Grip the wrench on the shaft, with the handle approximately level, and hang a stout hook over it. Tape or fasten the hook in position so it will not shift when the wrench handle drops. Then hang weights on the hook until the shaft starts to turn.

Measure the distance between hook and center line of shaft. Call this distance L, in feet, and find the total weight, W, in pounds.

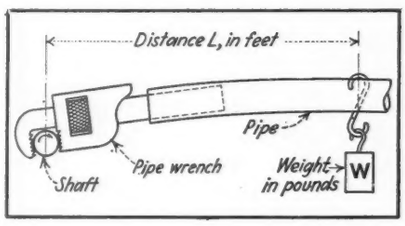
The motor size in horsepower can be found from the formula:

$$Horsepower = (6.28 \times L \times W \times Speed\ of\ Shaft) \div 33{,}000.$$

For example, assume that a shaft requires a weight of 47 lb. at a distance of 3½ ft. to turn it, and that it runs at 350 r.p.m. The horsepower required to drive it is:

$$Horsepower = (6.28 \times 3.5 \times 47 \times 350) \div 33{,}000 = 10.9$$

Making a reasonable allowance for bad conditions which may sometimes exist, it would probably be advisable to use a 15-hp. motor for this job.



If the motor must start frequently greater excess capacity may be needed to prevent abnormal heating.

After the load has been broken loose from rest, continued application of the same horsepower will bring it up to speed. The time required will depend largely on the amount of energy stored up in the moving parts. This in turn depends on the weight and dimensions of the parts and their speed, and usually is difficult to calculate even approximately. In general, however, an ordinary motor should be large enough to bring its load up to speed in 30 sec. or less.

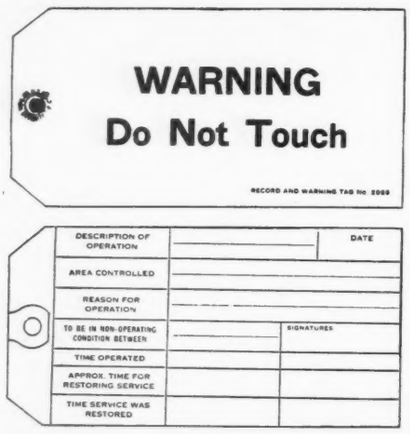
Coding pipes and conduits and painting them in different colors lessens hazards and avoids costly mistakes. Devise your own color scheme.

Tagging Safety to the Distribution System

FREDERIC OAKHILL, *Plant Engineer Bauer & Black Division of The Kendall Company, Chicago*

To prevent injury to workers and damage to equipment this tag is used to warn employees that changes are being made in distribution systems and that normal operating conditions are not in effect.

When changes must be made, the repair crew is required to mark open or closed switches, valves, or other apparatus with these tags, if the equipment is to be left in other than its normal condition. The person marking the equipment is responsible for properly filling out of the card, checking equipment when



it is to go back into operation, removing the tag, notifying all concerned that regular operation is restored.

After the tag has served its purpose it is delivered to the plant engineer's office and kept on file for one year.

Place a gramaphone needle in a pin chuck and you have a handy tool for inscribing fine lines and laying off accurate distances on drawings. When the point dulls, put in a new needle.

Hard-Alloy-Tipped Key Seats Itself in Worn Keyway

SOURCE, *Haynes Stellite Company New York*

When the keyway becomes worn so that a pulley or gear is loose on its shaft, a simple welding job will save considerable machining time and labor.

Take an oversize key, weld a thin layer of a hard-facing alloy onto one end, grind it to a sharp edge, and drive the key home. The hard alloy will enable the key to cut its way to a snug fit.

Working around furnaces in summer is hot, hot work. When operators found they couldn't stand up to the furnaces long enough to carry out their work schedules, they were allowed to choose their own hours (they picked night and early morning of course), were paid by the piece. Production increased.

Inspection Benches Painted Black

H. B. LEACH
Head of Standards Department
Pro-phy-lac-tic Brush Company
Florence, Mass.

Pale blue may be the best background against which to inspect ladies' hosiery. At any rate I understand that it and other light colors have been used successfully on inspection benches. However, we have chosen to finish ours in a dull black lacquer and think we have perfectly good reasons for selecting it.

In the first place, toothbrush bristles are white and stand out in somewhat sharper relief against the dead black than they would against the popular and pleasing light shades. Of course, you will say, those same white bristles would stand out pretty well against a nice jade green, and they would. But here is the rub. Toothbrush handles come in all shades and colors, some of them in the lighter hues, others in the darker shades, and the inspector not only has to inspect the bristles, she has also to inspect the handle, see that the trademark is properly imprinted, and so on. Obviously, if background were blue or green, it would clash with some of the colored handles. Black does not clash, perhaps because it is not a color at all, but rather the absence of all color. For our work and our product, certainly, it is the most satisfactory.

Daylight bulbs of 60-watt capacity give us localized lighting at these benches, which is of the proper quality and in the right quantity for fine inspection work.

To arrest downward trend of employees' energy as the day goes on, a plant has provided radios which may be turned on at noon, left on for remainder of the day.

Guide Block for Pulling Wires into Conduit

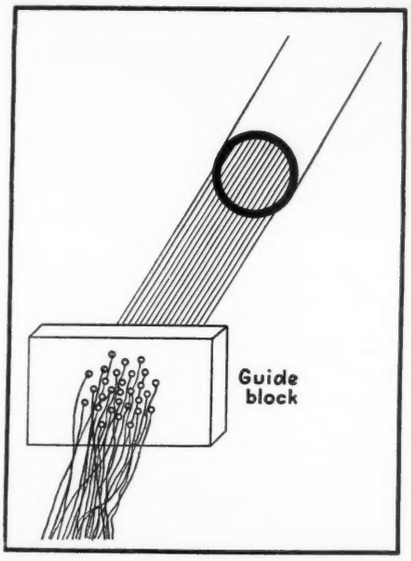
P. LINDHOLM, *Newark, N. J.*

When pulling wires into conduit systems, particularly where a large

number of control wires are pulled through a single, large conduit, the guide block shown in the sketch will be found helpful.

Wires that are pulled in at random tend to become crossed and when force is applied some of the crossed wires are pinched. The result is likely to be damaged insulation, which may break down later. Less force is required to pull in wires when this guide block is used, because they do not become crossed or twisted about each other. Furthermore, if it becomes necessary to pull out one or more wires afterward it will be easier to do so.

The block can be made from almost any material, such as hard wood, fiber, brass or steel. The

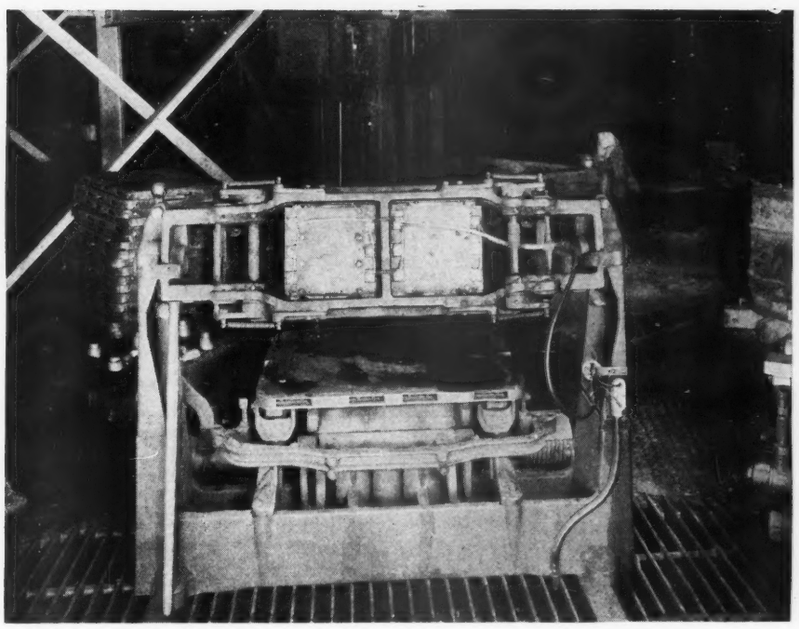


only requirements are that the holes be made large enough, and be reamed on both sides to prevent cutting the insulation. In use, the man feeding the wires can hold the block in his hand, or it can be mounted in any convenient way a short distance from the end of the conduit.

Short pieces of tinned, hard-tempered copper tubing had been regarded as scrap. It was found they could be used if they could be annealed, but a furnace would spoil the tinning. A spot welder with points contacting ends of the tubing did the trick.

Heated Patterns Raise Production 10 Per Cent

Several foundries in Cleveland heat their patterns electrically because it has been estimated that in this way they can get at least 10 per cent more production.



The warm pattern tends to dry the sand around it and thus gives a perfect mold, even though there are deep draws. With a well-designed heating job there may be no need of vibrating the pattern when withdrawing it from the sand.

Different types of molding machines, plates, and patterns require different types of heaters. It appears that the most satisfactory arrangement is to build the heaters into the patterns, where they are not so likely to be damaged, mechanically or otherwise. When the pattern is hollow and screwed onto a baseplate, the heating element can be located between the two or built into the latter.

If the electric heating elements are mounted under the plate on which the pattern is placed, as shown in the illustration, one group of heaters serves all similar patterns.

Many different types of patterns can be handled when the heating elements are mounted in a box, normally in the horizontal position, on which the pattern is placed while cores are put in the mold.

Asked how they pick up their best ideas, five plant men gave five answers. One reads his business periodicals, one visits plants in other industries, another talks with salesmen, a fourth depends on arguments with subordinates, and the fifth contemplates while shaving.

Heated Oil Cuts Time for Softening Leather Washers

Special leather washers used as grease seals in the tractors built by one company are so stiff when first made that if they were installed without softening, their wear would be greatly accelerated by any irregularities in the shafts.

It is necessary, therefore, to soak the washers in oil, but the length of time, 48 hours, required at room temperature to insure complete penetration of the oil was a serious drawback.

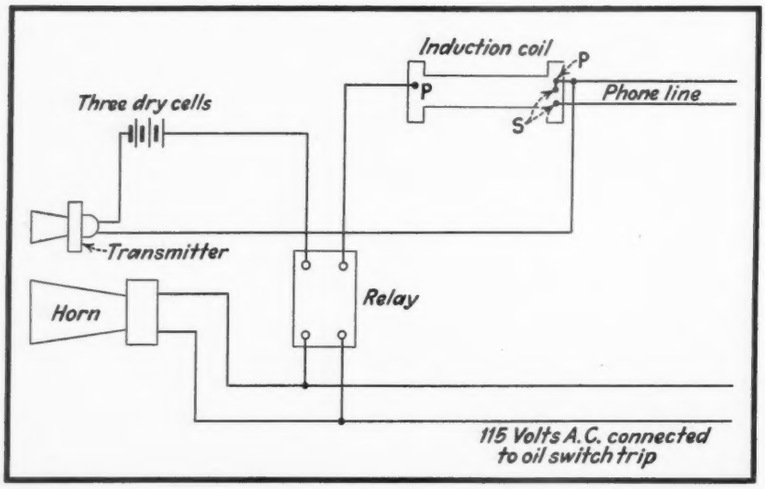
To speed up the process, there was installed an insulated tank that is heated by a thermostatically controlled 2½-kw. immersion heater. Time required for soaking the washers has been reduced from 48 to 2½ hours.

Telephone Transmits Alarm from Distant Substation

C. A. EDWARDS, *Chief Electrician*
The Long-Bell Lumber Company
Ryderwood, Wash.

A considerable amount of electrical equipment is used in our woods operations. It is supplied by a substation, located 4½ miles from town, which receives power over a 66,000-volt transmission line and feeds three 13,200-volt distribution circuits for several logging lines.

One of the important problems that had to be solved was the installation of a suitable signal that would notify the electrical department in



town when the circuit breaker on any one of the woods lines opened. Considerable expense would have been involved in building a signal line 4½ miles long. Eventually it occurred to me to mount a telephone transmitter close to the signal horn at the substation and connect it to the telephone line. The diagram shows the method of connection.

This scheme has worked very satisfactorily. Whenever it is desired to check conditions at the substation it is merely necessary to take down the receiver of any telephone in town. If the signal horn is blowing, indicating an open circuit breaker, it can easily be heard.

Vibration can cause operating difficulties and breakdowns, and once started it quickly grows worse. Keeping equipment in good shape tends to minimize it, and where it is unavoidable it should be isolated.

Special Notice

$10 will be paid for the best Operating Short submitted during the month of March. The Editors are the judges. Other Shorts accepted will be paid for at attractive rates

Attendance of 4,000 employees, 90 per cent of them women and girls, is maintained 99 per cent constant in a cigar manufacturing plant, thanks to air conditioning.

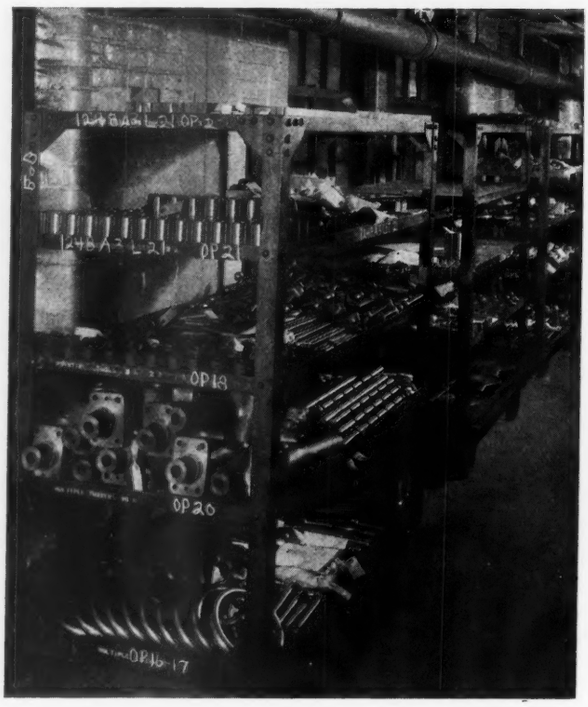
Lot-Storage of Parts Is Big Help in Assembly

Lot-storage of parts still is a new story for many plants. Briefly, here's what it is, and how it works, as applied by Warner & Swasey Company, Cleveland, in building turret lathes:

Component parts, as they are machined, are sent to the stockroom, where they are placed in bins. Say that a lot of 20 machines of a given size is to be assembled. An order for the necessary parts is sent in advance to the stockkeeper.

The stockroom force places all the parts necessary for the assembly upon the parts racks, as illustrated. These racks, with integral skid bases, are picked up on mobile electric trucks and transported to the assembly floor. There they stand until emptied of parts as assembly progresses.

The number of racks per lot depends upon the size of the lot. For a small lot of small machines, one or two racks may suffice.



Difficulty in pulling wire through conduit? Try using some soap chips, slightly moistened.

The Man Must Fit the Job

SOURCE, *New Departure Division General Motors Corporation Bristol, Conn.*

When it comes to employment all men are certainly not equal for any one particular job. Individuals are fitted for different types of work and it is our employment department's task to determine whether or not the applicant is suited to the job. Four questions the department asks itself when considering a man:

Can he do the work to our satisfaction?

Will his general physical condition permit him to do this work?

Will he be able to progress on the work to his satisfaction?

Will he cooperate with others?

If affirmative answers can be given to these questions and if there is an opening, the applicant gets the job.

Workers who eat frequently during the day work with greater enthusiasm and less fatigue, and get more done, says a prominent physiologist. Between-meal snacks are really to the benefit of both management and employees.

Valve Installation and Maintenance

Much progress in the development of valves and valve metals has been made in the past few years, but valve repair is still a large item in plant maintenance costs. In many instances much of this expense can be eliminated by proper installation. Some precautions to be taken when installing valves are:

1. A valve must be given the same consideration accorded to any other finely made equipment. Falls or rough treatment usually result in broken parts or stem distortion.

2. Threaded connections must be made with care. Avoid cutting pipe threads too long. A valve may be ruined if the pipe end strikes the seat. Put pipe compound on the pipe thread, not on the valve thread. If put on the valve thread, the compound will be pushed into the valve as the pipe is screwed in, possibly causing trouble.

3. Prevent dirt, especially metallic chips or gritty substances, from entering the valve; these particles will cut and scratch the seating surfaces.

4. In taking a valve apart, knowledge of its construction is important. When reassembling, be sure that the disk and stem are in the open position, and that all inside surfaces are clean. Permanent damage to the valve may result from disregarding these precautions.

5. Keep the valve closed when installing. The valve is then more rigid and easier to handle, and foreign material is kept off the seating surfaces.

6. Wrench strains are a prolific source of valve troubles. When installing or removing a valve, always apply the wrench at the valve end nearest the joint to be made or broken. Avoid the unnecessary strains resulting from using too long a wrench. A threaded joint requiring excessive force to prevent leakage is usually defective because of a faulty pipe thread. Breaking an obstinate joint is most easily accomplished by using a short wrench and tapping it lightly.

7. Screwing too long a piece of unsupported pipe into a valve is bad practice. The leverage exerted by the weight of the far end may cause distortion of the valve body.

8. Provide ample support and means of taking care of the expansion in the line. Where valves must carry the sag or expansion, excessive bending strains are set up which may cause leakage and possibly permanent damage to the valve.

9. When the job is completed, open all valves and blow out thoroughly before putting into service. After cleaning the line of all foreign matter that might cause cutting of the seating surfaces or prevent complete closure, the valves may be closed and the line put in service.

10. With pressure on the line, check for leakage. Tighten packing glands just enough to stop leaks. Too much pressure on the packing shortens its life and interferes with proper valve operation.

After steam has been turned on a line it is common practice to tighten the bolts on all flanged joints to prevent any leakage that might result from expansion. Bonnet joints of the valves should receive the same treatment.

11. Wrenches should be applied to the handwheels of valves with the greatest of care. If a valve is in good condition, the handwheel is usually large enough to effect complete closure. Should a valve require additional leverage when being opened, use of a short wrench and light tapping is effective, and easier on the valve. Large gate valves on lines carrying relatively high pressures should be equipped with bypass valves, so that the pressure on both sides of the valve may be equalized before opening. In addition to this function, bypass valves prevent the wire drawing that would result if a large valve were cracked to warm up the cold section of piping on the downstream side.

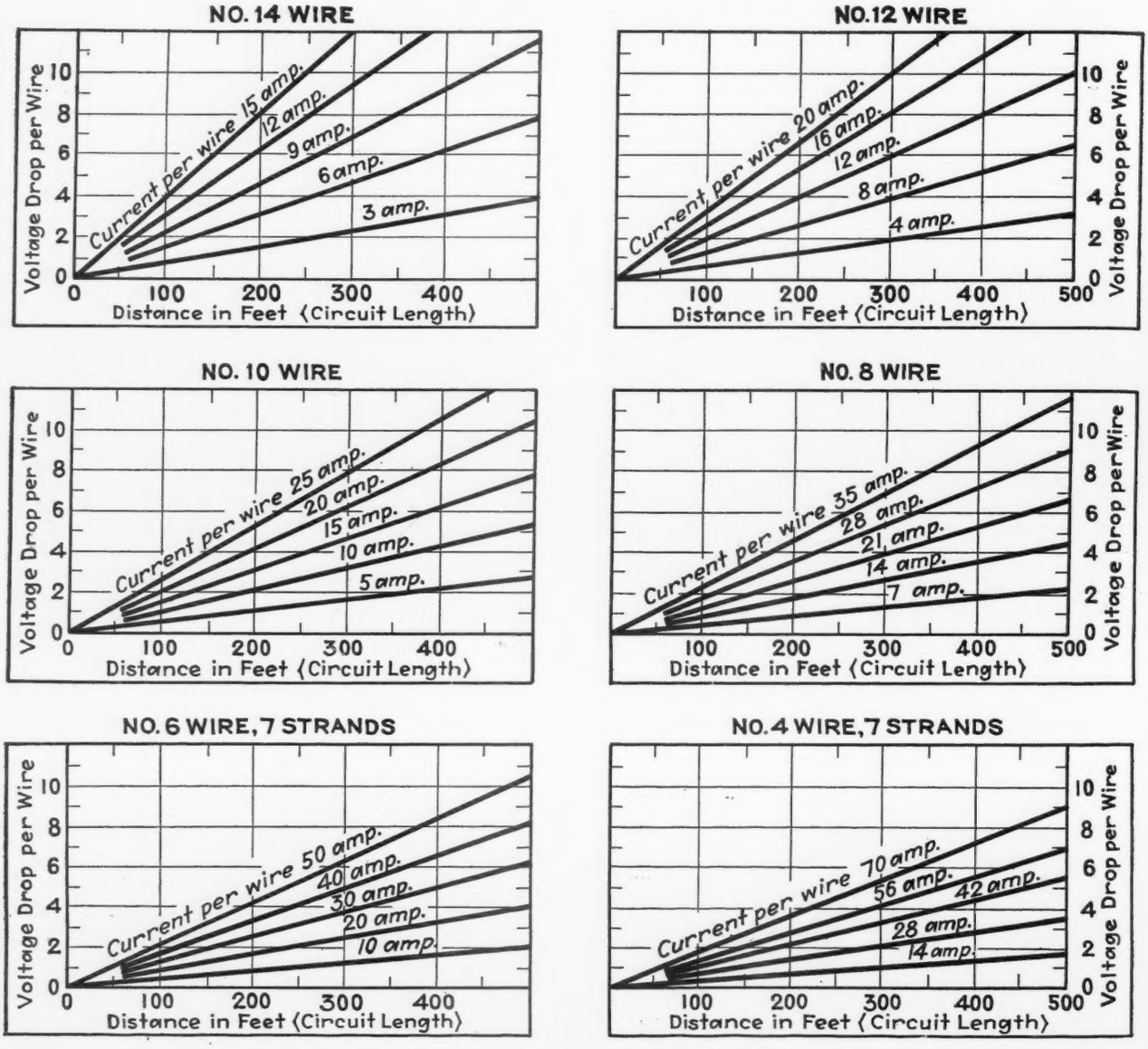
12. Make periodic inspections of all valves and piping after placing the system in service. Slight packing or bonnet joint leaks, unless attended to in their early stages, will often mean a repacking job, or require the installation of a new bonnet gasket. Leakage around the threads of screwed-type bonnet joints, if allowed to continue, will cut the metal and eventually ruin the valve.

13. Care in valve operation is essential to low maintenance costs. When closing a valve, be sure no dirt is on the seating surfaces to cause leakage. If leakage is apparent, open and close the valve several times to blow the obstruction from the seating surface. Care should be exercised when warming up a cold line to avoid destructive water hammer and sudden strains due to expansion.

Prepared by S. H. COLEMAN, Waynesboro, Va.

Line Voltage Drop

In Each Wire of Three-Phase, Four-Wire Circuits, 60 Cycles, 120 Volts Phase to Neutral



WHEN calculating the voltage drops per phase wire shown in these curves it was necessary to make certain assumptions regarding conductor temperature under continuous load and the spacing of conductors in the conduit.

Resistance of the conductors was based on a temperature of 75 deg. Fahrenheit.

The electrostatic capacity of short, low-voltage circuits is so slight that it is of no practical consequence.

Line reactance is more important, although in the case of short feeders of the lower capacities it is often so small that it is almost negligible; therefore it is sometimes disregarded in voltage drop calculations. In this instance calculations for each size of conductor were made for average spacing, based on the standard methods of installation recommended by the National Electrical Code.

A power factor of 80 per cent was chosen, since this figure is a fair average of the values usually found in plants where mixed power and lighting loads are supplied by a three-phase, four-wire system.

Prepared by J. L. YOUNG, St. Marys, Ohio

What's NEW in Equipment

Barrell Packer

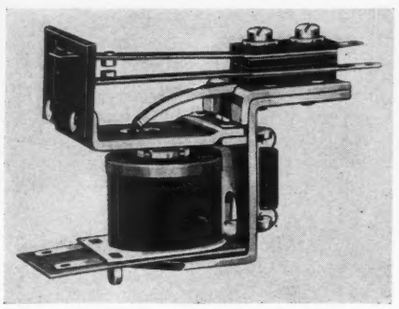
Electric vibrating barrel packer, of low head and capacity up to 800 lb. gross, stands only 16½ in. high. It is designed for floor-level operation. Head is circular, 30 in. in diameter, and is provided with ring or lugs to fit any container up to maximum diameter. Stators are energized by pulsating direct current. Jeffrey Trailer Division, The Jeffrey Mfg. Co., Columbus, Ohio.

Circuit Breakers

"Multi-Breaker" load center affords fuseless service for branch circuits of up to 50-amp. capacity. Time lag protection on overload, but breaker will always act in advance of the danger point. Has swing-out interior and solderless connectors. For 2- and 3-wire grounded solid neutral and 2-, 3-, 4-wire insulated solid neutral systems. Surface or flush mountings. The Trumbull Electric Mfg. Co., Plainville, Conn.

Relays

Series 110 is for a.c. service and operates on any standard cycle and on any voltage up to 220. It draws about 2 watts.



Contact combinations available range from single-pole, single-throw to four-pole, double-throw. Adjustable air gap has setting which, it is said, is unaffected by vibration. Silver contacts. Screw-type mounting, or can be supplied mounted on molded plastic base wired to terminals. All parts are cadmium plated. Series 115 is similar to Series 110 but is designed for d.c. operation. Guardian Electric Mfg. Co., 1622K West Walnut St., Chicago.

Thermostat

Type KO thermostat is made of stainless steel and is corrosion-proof. It controls pressure and temperature and requires a mounting space of only 4 1/16x 4¼x1⅞ in. Is rated ¾ hp., 110 to 220 volts a.c.; and 1/3 hp., 150 volts, d.c. Temperature differential ranges 4-20 deg. Low pressure differential ranges 4-30 lb. High pressure differential of 30 lb. is non-adjustable. Ranco, Inc., Columbus, Ohio.

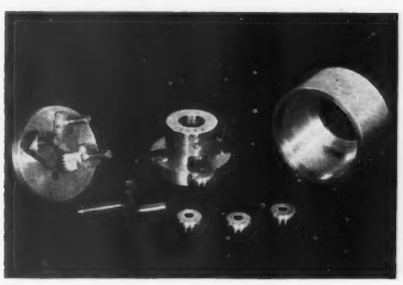
Valves

To line of globe and angle valves have been added 1¼-, 1½-, and 2-in. sizes. They have hard stainless steel seats and disks, and trim is said to be heat-treated to a hardness of 500 Brinell. Also said

to be highly resistant to wiredrawing and steam cutting. Hancock Valve Division, Consolidated Ashcroft Hancock Co., Bridgeport, Conn.

Flexible Coupling

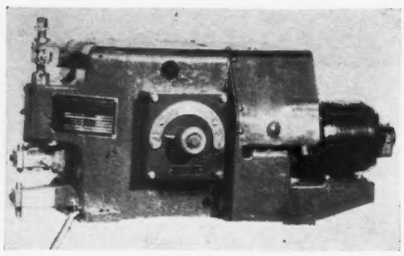
No. 1 universal, self-aligning shaft coupling for drives difficult to align. Allows parallel misalignment of 3/16 in., and angular misalignment of 15 deg. It has a dust seal. Made in horsepower range of 3-500 hp., and in bore sizes of ¾ in. and up. Harris Coupling Co., 265 West 40th St., New York.



Spot Welder

Model A bench-type spot welder is powered with a 10-kva. transformer and driven by a 1/6-hp. motor working through a reduction unit. Cam at the back actuates a rocker arm which moves a welding spindle up and down with a straight line motion. Operation is controlled by a foot switch acting through a solenoid clutch.

Capacity of machine is 2 pieces of 1/16-in. clean iron or steel. It has a pressure range of 25-100 lb., and a throat depth of 4¾ in. Dimensions: 15¾ in. wide, 32 in. long, 17¾ in. high. Thomson-Gibb Electric Welding Co., Pleasant St., Lynn, Mass.



Helmet

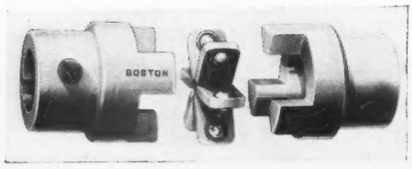
Made of vulcanized fiber, this "Head Protector" helmet is a seamless hat of great strength and lightness. Is lined and ventilated. It is said that head band is supported in such manner as to evenly distribute the weight and eliminate sway. Sizes 6½-7⅝ in ⅛ increments. The Strauss Co., Third and Ross Sts., Pittsburgh.

Tubing Cutters

Tubing cutters of new design have increased capacity without increase in size or weight. Manufacturer claims that roller-type cutter with knife-blade wheel makes a rapid smooth cut without denting, twisting, or tearing tubing. Each cutter is equipped with knife-blade reamer. Three sizes: No. 10 with outside diameter range ⅛-⅞ in.; No. 20, range ½-1⅜ in.; No. 30, range ⅞-2⅛ in. Armstrong Mfg. Co., Bridgeport, Conn.

Flexible Couplings

Ball-bearing-type flexible couplings are of three-jaw design. They are equipped with inserts, having hardened and ground balls similar to those used in ball bearings, in contact with hardened and ground jaw surfaces, to carry the load. Holes and



hubs are soft, permitting alterations in the size of the bore. Hole diameters of ½, ⅝, and ¾ in. Designed for fractional horsepower installations. Boston Gear Works, Inc., North Quincy, Mass.

Casters

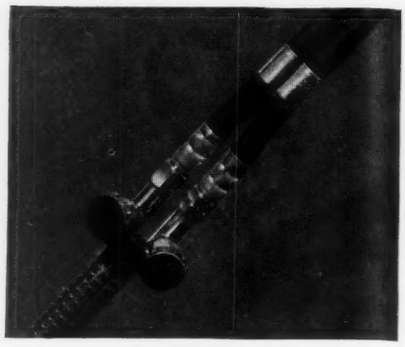
Made of Monel for use in plants where corrosive agents are encountered. Designed for application on trucks, hampers, and wheeled conveyors of all kinds. All metal parts, including bearings, shaft, and spacers, are of Monel. Wheels are of rubber composition. Bassick Co., Bridgeport, Conn.

Drills

Line of small flat drills in diameters ranging 0.002-0.100 in. Made of high-speed steel, and are said to be accurate as to dimension and to be accurately centered. Grobet File Corp. of America, 3 Park Place, New York.

Air Hose

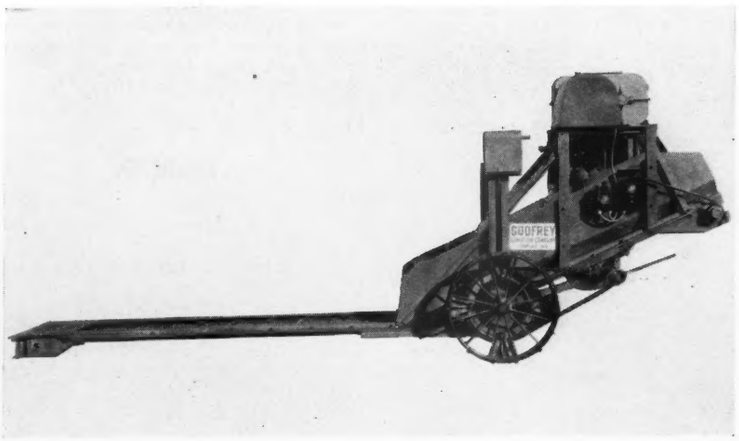
"Airco Twin" air hose consists of two individual lines of hose molded into one. Two lines of cord-reinforced hose are molded side by side into a single flexible unit. To install, you split along the joint line at each end of the hose a sufficient distance to form a convenient "Y" at tank



and torch ends. For quick identification, the acetylene line has a bright red cover, the oxygen a bright green. Air Reduction Sales Co., Lincoln Building, 42d Street, New York.

Switchgear Units

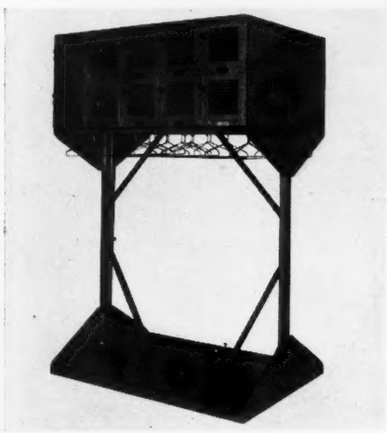
Factory-built, metal-inclosed switchgear units are shipped as a complete assembly. They consist of cubicles in which are mounted circuit breakers, buses, disconnecting switches, instrument transformers, and other auxiliaries. On the hinged front panels are mounted relays and meters. Disconnecting switches are located in upper compartment and operated by a hook-stick. There is provision for extension of the assembly with a removable cover over the end of the buses. Westinghouse Electric & Mfg. Co., East Pittsburgh.



Portable Conveyor

"Trakonveyor" is a loading conveyor which receives materials at floor level and elevates them for deposit on conveyors. Its receiving portion is horizontal so that it can be placed under freight cars to receive materials as they are dumped. Flights are moved by drag chains with a 3-hp. electric motor or gasoline engine supplying the motive power. Model B is moved by hand, while Model BP is self propelled. The latter has a traction speed of 47 f.p.m, forward or reverse. Godfrey Conveyor Co., Elkhart, Ind.

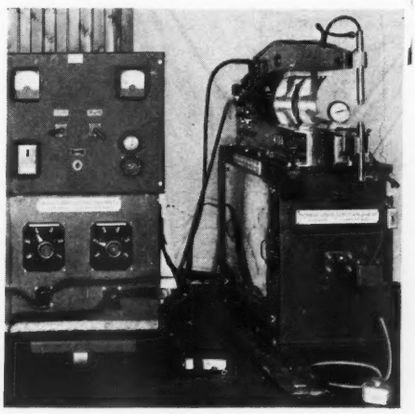
Locker



The "Shoprobe" is a new type of locker which can be used in general locker room or moved about to meet periodic requirements of different departments. It accommodates 20 persons with a separate, lockable compartment for personal belongings. Coat hangers are not removable and a chain can be supplied for locking coats to the hanger through the sleeve. Uses 12½ sq.ft. of floor space. Heavy all steel construction. Lyon Metal Products, Inc., Aurora, Ill.

Spot Welder

Spot welder is designed for welding of aluminum. Consists of welder proper with its main transformer, a separate auto transformer, and two electronic control panels. Is made largely of aluminum. Has bell on panelboard that warns operator if welding variables are not right. Has recording device, charting the value of current flow as each weld is made. Contact surfaces are silver-plated. Thomson-Gibb Electric Welding Co., Pleasant St., Lynn, Mass.



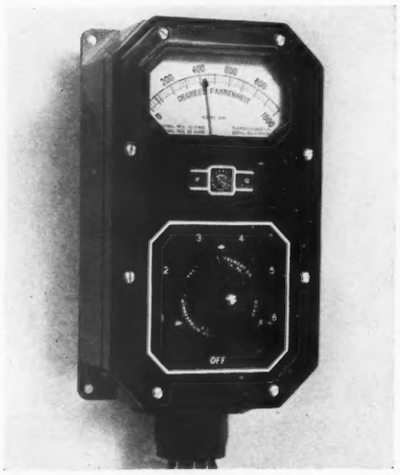
Electric Drill

No. 712 half-inch electric drill has universal, 60-cycle motor for 110, 150, 220 or 250 volts. No load speed is 400 r.p.m., rated load 3.4 amp. at 110 volts. Moving parts are of heat treated alloy steel, housing of aluminum. Double-pole, inclosed switch. Overall length of 14½ in. Millers Falls Co., Greenfield, Mass.

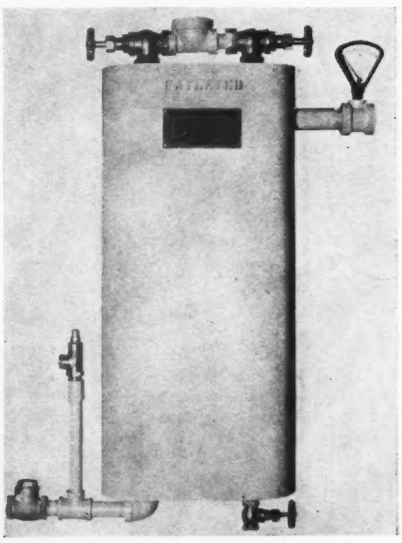
Lighting Fixture

The "Catchon Downlight" consists of an aluminized reflector with an open bottom fitted with a louver which affords a large downward light component. The unit dispels darkness in the ceiling and allows a high intensity of light to be directed on drafting table, desk, or workplace. Has 12-in. top diameter, 6⅞-in. bottom diameter, and 4-in. depth. Uses 200-watt lamp. The F. W. Wakefield Brass Co., Vermilion, Ohio.

Pyrometer

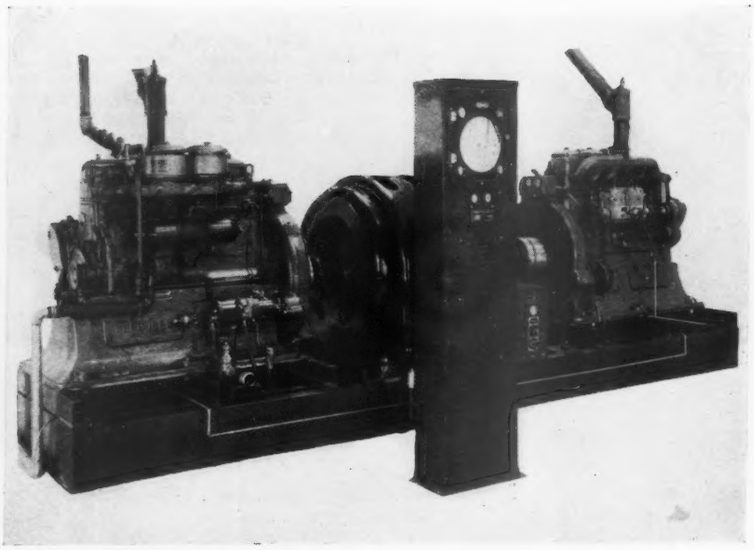


Designed especially for diesel engine service this pyrometer is available in three temperature ranges—0-1,000, 0-1,200, and 0-1,600 deg. F. with switchpoint combinations of 4, 6, 8, 12, 16, or 24. Switchpoints are extra large to withstand hard usage. Leads 20 in. long are brought from switchpoints through a pipe fitting in bottom of the box, permitting use of a junction box at a remote point. Enameled metal scale is printed in black and white. The Brown Instrument Company, Wayne and Roberts Aves., Philadelphia.



Water Heater

Using steam as the heating medium, this heater has two chambers where water is divided into thin sheets for intimate mixture with the steam. Cold water is partially warmed in the first chamber and up to delivery temperature in second. Cold water enters at bottom, steam at top. Check valve keeps steam from backing into



water line. Drain at the bottom for cleaning out unit. Has thermometer at outlet. The Schwab Machinery & Supply Co., 201-213 Lucas St., Toledo, Ohio.

Unit Heater

Revolving discharge unit heater gives even distribution of heat in all directions. Air velocity is said to be sufficient to carry the heat to the walls and remote corners, and working areas are uniformly heated. The revolving discharge portion is available separately for attachment to installations of the company's other heaters. L. J. Wing Mfg. Co., 7th Ave. and 14th St., New York.

Pumping Unit

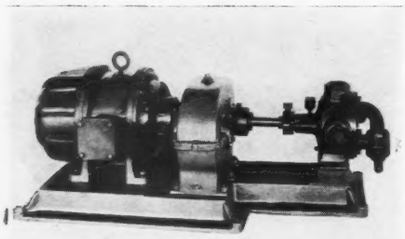


Figure 108 pumping unit is back-geared unit on L-shaped base. Pump speeds can be reduced to as low as 100 r.p.m. from a standard 1,750-r.p.m. motor. Gear box is totally inclosed and gears operate in bath of oil. On units using motors of 2 hp. and above, reduction gears are made of steel. Has end-thrust bearing for rotor shaft. Sizes range from 20 gal. per min. at 450 r.p.m., to 90 gal. per min. at 390 r.p.m. Viking Pump Co., Cedar Falls, Iowa.

Merger

Ideal Commutator Dresser Co., 1416 Park Ave., Sycamore, Ill., has announced the acquisition of Marshall Electric Company, Elkhart, Ind. Operations of the acquired company will be transferred to Sycamore where manufacture of voltage regulation equipment will be carried on.

Diesel Plants

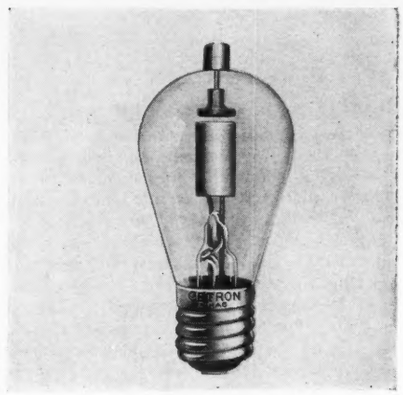
"Tecomatic" units are standardized diesel-electric plants in sizes 45, 90 and 140 kw. Each consists of a double-ended 1,200-r.p.m. generator driven by two diesel engines through automatic over-running clutch couplings. A dual-type, air-operated "Tecomatic" exhaust temperature recorder is furnished with each double-ended unit. This provides a complete automatic control as well as a daily recorded log of each engine operation. Control starts and stops an adjacent engine on an increase or decrease in the load above or below the capacity of its respective engine. Any number of these units can be operated in parallel. They can also be applied to automatically balance steam-driven power plants. In multiple-unit a.c. applications the generators float on the line as synchronous condensers when not operating as generators. Thermal Engineering Co., 716 Columbus Ave., Boston.

Dust Collector

An electrostatic precipitator for general industrial air cleaning works at high efficiency and may be used for salvaging valuable dust, mass air cleaning, or removing objectionable particles from gas or vapor. Unit consists of collector cells, ionizing assembly and power pack. Power pack is small, and entire unit does not have great space requirements. It operates at low voltages and is said to remove particles as small as one-fifth micron. Pangborn Corp., Hagerstown, Md.

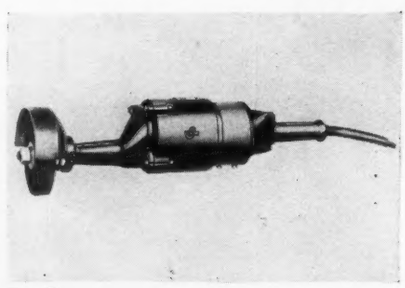
Rectifier

Type 2-RA-6 mercury rectifier charger bulb is guaranteed by its manufacturer for 2,000 hours. Filament is built on non-sagging principle. Has universal cap connection which guards against breakage of the glass seal in the event the anode lead is struck. Filament characteristics: 2 volts and 13 amp. Inverse peak voltage of 300, output of 6 amp. Continental Electric Co., Geneva, Ill.



Grinder

No. 970-G grinder is a general purpose grinder having totally inclosed, fan-cooled motor. Motor is completely incased in copper shield which excludes dust and conducts heat away. Switch is separately inclosed. Two-row ball bearings at work



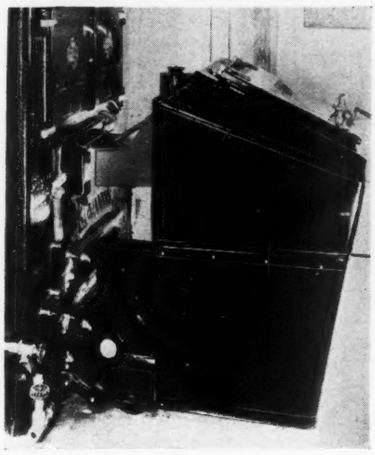
end of spindle. Takes 6x1-in. wheel. Free speed is 3,900 r.p.m., loaded speed 2,600 r.p.m. Overall length 24½ in. Chicago Pneumatic Tool Co., 6 East 44th St., New York.

Clutch Release

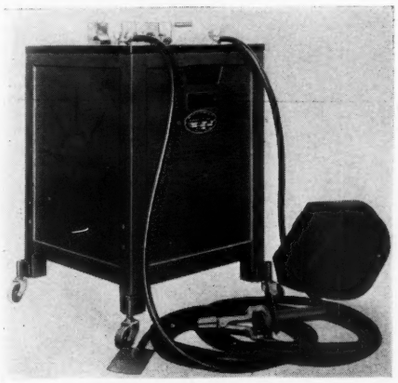
Remote control clutch release permits instant disengagement of drive by pressing a pushbutton placed near the drive or at a distant point. Any number of pushbutton stations may be used so that the machine may be stopped from any one of a number of locations. Clutch is engaged manually. Can be used to stop machine instantly without stopping the motor. Consists of an electromechanical latch mechanism connected to the yoke of a standard friction clutch by a spring and lever arrangement. Operates from lighting circuit. The Hilliard Corp., Elmira, N. Y.

Portable Stoker

Portable stoker for small boilers is mounted on wheels and can be moved to and away from the furnace. It is of the overfeed type and uses fine grades of coal. A ¼- or ½-hp. motor operates a distributor through reducing gears. Distributor consists of a circular plate and distributes coal over entire grate area by means of



centrifugal force. Screw conveyor is used to bring coal up to distributor level. The Kirby Mfg. Co., 238 South Union, Decatur, Ill.

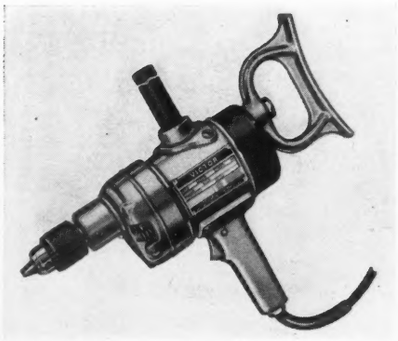


Welder

Portable arc welder, known as "Standard Arc," is available in four capacities from 130 to 300 amperes. Is equipped with rotary knife switch control with amperage marked for each welding step. It is transformer type without reactance control or sheet metal attachment. Can be used for welding on grounded surfaces without danger to operator. Miller Electric Mfg. Co., Appleton, Wis.

Transformer

Types 70 and 80 "Variac" transformers are designed for applications where voltage is to be held constant by manual adjustment or varied over a limited range. Type 70 furnishes 50 watts; type 80, 250 watts. Various voltage-current combinations can be supplied. Can be connected to furnish fluctuating output from 115-volt, 50-60-cycle constant input, or to give constant input with fluctuating line voltage. General Radio Co., Cambridge, Mass.

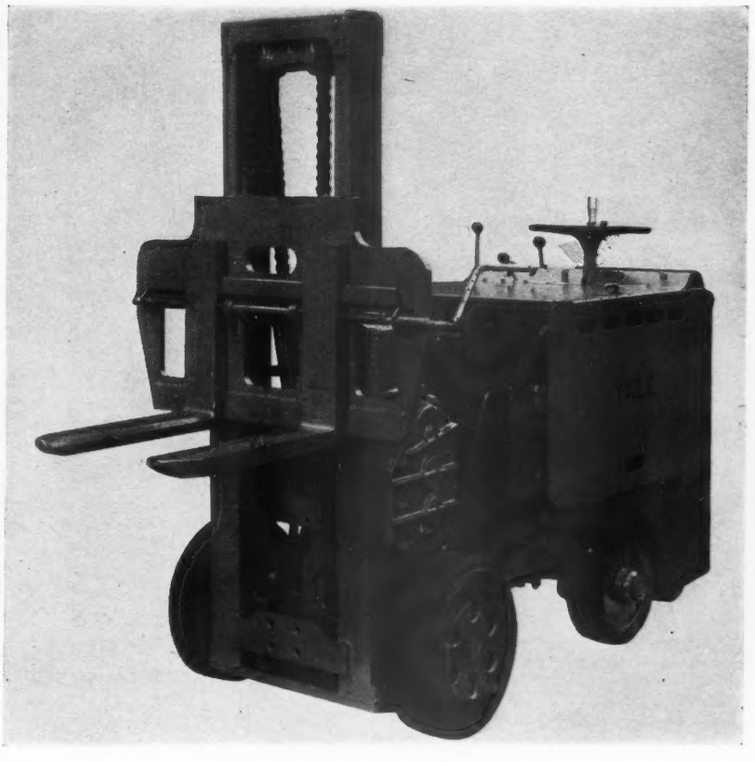


Electric Drill

No. 124 "Victor" electric drill has ½-in. capacity. Has heat treated nickel steel gears and a universal motor mounted on seal type ball bearings. Aluminum alloy housing and three-jaw chuck. Combination spade and breast plate handle and a pipe handle that can be attached for working in close quarters. No load speed is 500 r.p.m. Is 15½ in. long, weighs 12½ lb. Stanley Electric Tool Division, The Stanley Works, New Britain, Conn.

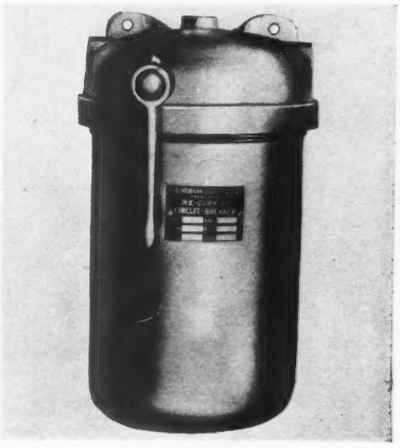
Lift Truck

Fork-type, high-lift truck is designed for pig handling in metal refining industries, and for pallet handling. Maximum capacity of 4000 lb. Can turn around in an aisle only 6 in. longer than the total length of truck and load. Two sprocket hoist chains are each capable of supporting the load. They operate through a triple gear reduction. Drop forged chrome nickel steel gears are used throughout. Driving wheels are weighted. The Yale & Towne Mfg. Co., 4530 Tacony St., Philadelphia.



Circuit Breaker

"Re-Cirk-It" breaker is available in instantaneous and time-delay types for any ampere rating from 50 milliamperes up to 35 amp., and for circuits operating on any voltage up to 250 d.c. or 460 a.c. Can be had in 1, 2, or 3 poles. Unit may be reclosed immediately after opening. Time-delay types are available in any one of four different time lags. Can be had in open type, plastic cases, or special housing for hazardous locations. Heinemann Electric Co., Trenton, N. J.



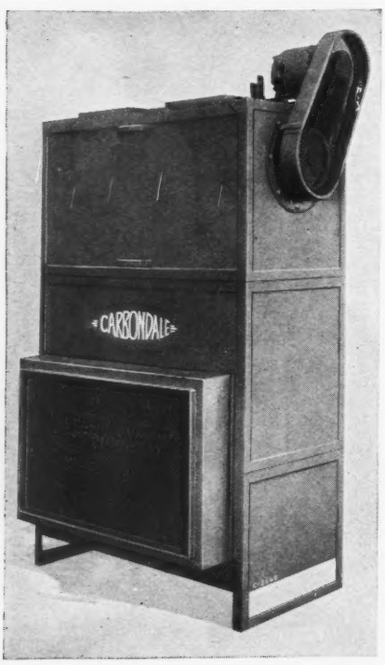
Lubricating Fitting

Alemite hydraulic threaded drive fitting makes its own thread when driven into a ⅜-in. hole. If broken, it can be replaced by unscrewing it from machine and replacing it by a similar fitting which is simply screwed into the same hole. Since the hole for the fitting must only be drilled

and does not have to be tapped, the cost of making the original installation is comparatively low. Four types: Model 1720 is a straight fitting; 1721, a 30-deg. elbow; 1722, a 67½-deg. elbow; 1723, a 90-deg. elbow. Alemite Division, Stewart-Warner Corp., 1870 Diversey Parkway, Chicago.

Air Conditioning Unit

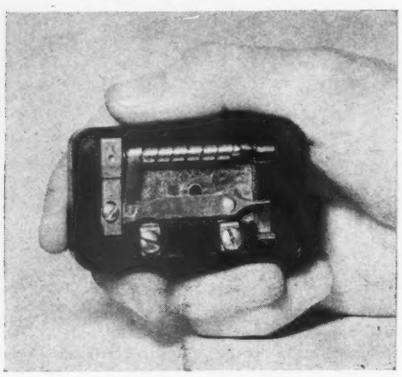
Line of unit air conditioners has wide range of air and refrigeration capacities. Each element is a complete and separable section in a compact cabinet. One section contains fan assembly with motor, another the coil and humidifying assembly, and another the base and cleaning ele-



ments. Unit cools, dehumidifies, heats, humidifies, cleans, and circulates air, making it a complete conditioner. Can be had without humidifying and heating elements if desired. Cabinet is constructed of heavy steel frame, coated inside and out with waterproof and sweatproof insulation. Outside surfaces are finished in a rust-resisting enamel. Carbondale Division, Worthington Pump & Machinery Corp., Harrison, N. J.

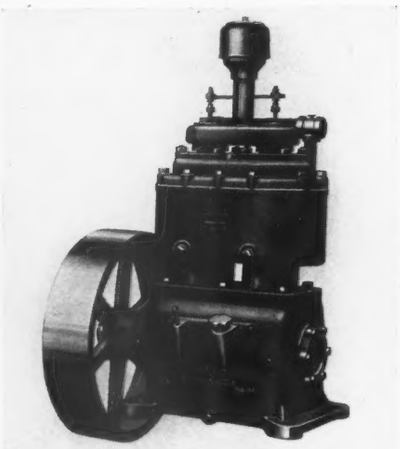
Overload Switch

For fractional-horsepower motors the "Thermo-Tector" affords thermal overload protection. Self-contained, it operates on line current and is arranged for conduit or motor terminal box mounting. When an overload occurs the switch automatically disconnects motor from the line before motor becomes too hot. Motor is automatically reconnected when it cools. Available in ratings for a.c. fractional-horsepower motors having rated full load currents from 1.3 to 10.4 amp. General Electric Co., Schenectady, N. Y.



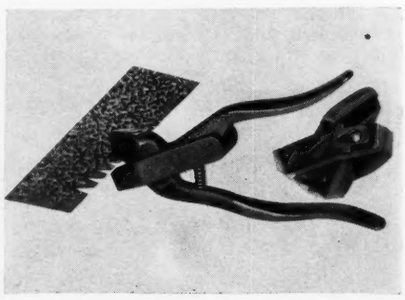
Air Compressor

Model "C" compressor features increased capacity with no increase in size over the company's earlier models. Head is equipped with large area, short intake passages. Oversize ports, straight-line air flow, and cooled air intake. Air enters the cylinder at low temperature. Made in sizes from 3 to 60 hp. Larger sizes are "V" type with four-cylinder construction and can be furnished either as line shaft or motor driven, or can be furnished as complete self-contained units, motor or gasoline engine driven. Curtis Pneumatic Machinery Co., St. Louis.



Tube Cleaner

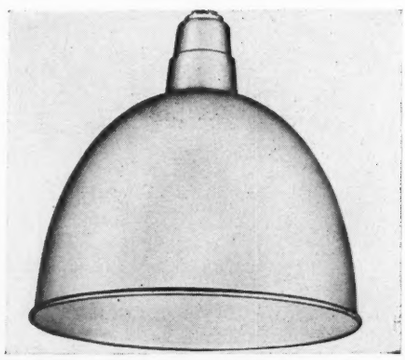
This new tube cleaner has been developed for small tubes from ⅝ to 1¼ in. inside diameter. Small air turbine is of the two-stage, four-blade type with cylinder an integral part of the outside case. Contains only five moving parts which include the rotor and four blades. Speed of 6,000 r.p.m. at 80-lb. air pressure makes it possible for the cleaner to remove scale and incrustations of considerable thickness. The Airetool Mfg. Co., Springfield, Ohio.



Notching Tool

Notches sheet metal for making box corners, curved flanges, etc. Makes notches any depth up to 13/16 in. Full opening in die to permit punchings to fall through. Double-duty adjustable depth gage does not project beyond nose of die. Tool is clean cutting and has fast action. Whitney Metal Tool Co., Rockford, Ill.

Reflectors



Aluminum reflectors are designed for use with 400-watt high intensity mercury lamps where the mounting height is 18 ft. or over. They are made from 14-gage commercially pure aluminum sheet, are said to be strong and durable. Mogul type socket is rigidly mounted in hood. Westinghouse Electric & Mfg. Co., East Pittsburgh.

TRADE LITERATURE

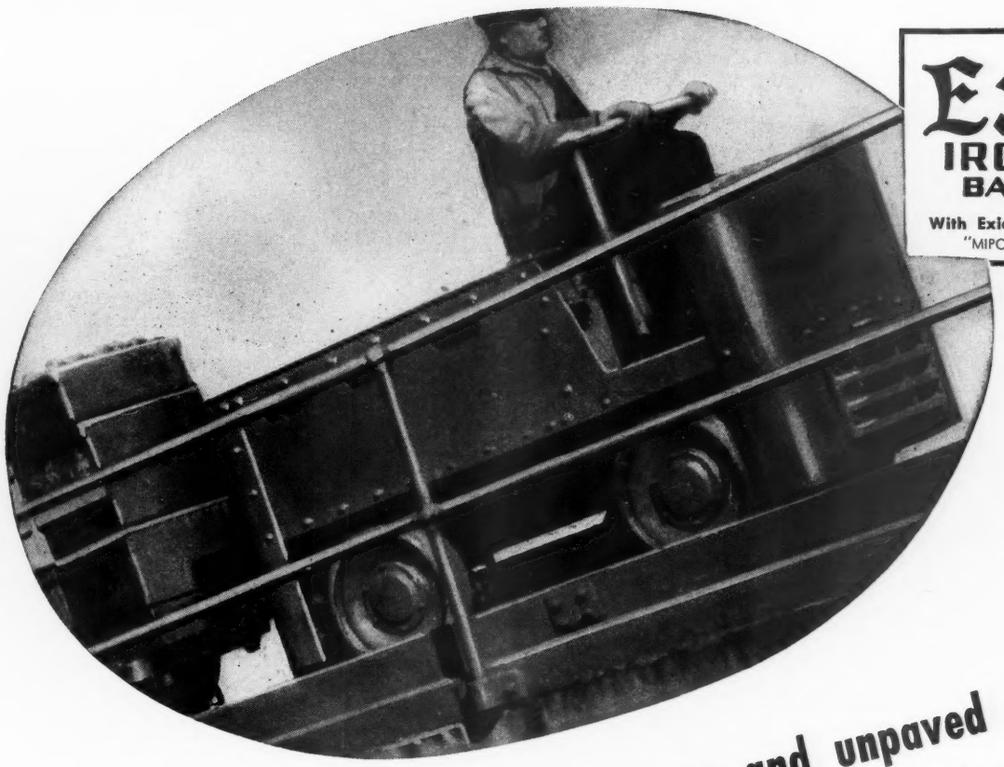
Arc Welding—Catalog, on new 40-volt simplified arc welding equipment.—Hobart Bros. Co., Hobart Square, Troy, Ohio.

Batteries—Booklet, on Durapak batteries for materials handling equipment.—USL Battery Corp., Niagara Falls, N. Y.

Belts—Folder, containing illustrations of transmission belt installations.—United States Rubber Products, Inc., 1790 Broadway, New York.

Bonded Metals—Two folders: one on bonded metals for use in manufacture of electrical devices, one on pre-crimped and pre-finished metals.—American Nickeloid Co., Peru, Ill.

(Continued on page 96)



Exide
IRONCLAD
BATTERIES
With Exide **MIPOR** Separators
"MIPOR," Reg. U. S. Pat. Off.

"With steep ramps and unpaved roads EXIDE-IRONCLADS have given us excellent performance"

"FOR eighteen years, Exide-Ironclad Batteries have propelled our electric industrial trucks under severe conditions. Some outside roadways are unpaved, with rain and snow causing the usual mud and ruts; inside roadways are paved but on different levels, which necessitate ramps of various grades, some rather steep. They are in use daily, year in and year out, with long hours at a stretch.

"These batteries have given such satisfactory performance that whenever replacements are necessary the order will call for 'Exide-Ironclad'."

Here is a letter from a large manufacturing firm using a number of electric industrial trucks. It brings out a highly important point—Exide-Ironclad *performance*. The tremendous and sustained power of these batteries makes them ideal for handling exceptional loads and negotiating exceedingly steep grades. An eighteen-year experience such as that mentioned above is ample demonstration of the ability of the Exide-Ironclad Battery to handle difficult jobs.

Exide-Ironclads have the four essentials for material handling service under modern production conditions . . . high power ability, high electrical ability, extreme ruggedness, and long life. Write for free booklet, "In Selecting Any Motive Power Battery Be Sure."

Truck illustrated made by The Elwell Parker Electric Company

THE ELECTRIC STORAGE BATTERY CO., Philadelphia
The World's Largest Manufacturers of Storage Batteries for Every Purpose
Exide Batteries of Canada, Limited, Toronto

It's this way in Washington

CARTER FIELD
Washington Correspondent

Federal control of wages and hours in industry—the old NRA objectives—seem to be coming closer with every development. Most lawyers think Senator George W. Norris right in his conviction that even the packing of the Supreme Court as proposed by President Roosevelt would not accomplish the reforms desired without a constitutional amendment. But most observers think the Supreme Court move helps toward the constitutional amendment—centers public attention on it.

* * *

Somehow the "swing" is on. A very pronounced and self-admitted Tory was discussing with several senators the plight of a certain corporation now enmeshed in Federal Trade Commission difficulties.

"Of course the company is in a bad way," he was saying.

"Just what did this company do that was so dreadful?" asked the senator.

"Why, it has been using strike breakers," said the Tory.

"I am surprised you think a company has not the right to employ whom it pleases," grinned the senator.

"Well," admitted the Tory, somewhat sheepishly, "not since the election of 1936. It seems to me that sort of thing is out of step with the times now."

* * *

None of which answers the rather pertinent question, however, which so complicates the General Motors strike situation: How is the particular minority which is entitled to stop work by a sitdown strike to be determined? The facetious answer of course would be: When that minority is recognized by John L. Lewis—but this throws little light on what Washington will do in future labor disputes.

President Roosevelt's timing was forced on his Supreme Court proposal. Too many senators were giving out views, in radio speeches, etc., which were tending to build up opposition to the very thing the President was working toward—doing it of course with not the slightest idea of what was in the President's mind.

For example Senator Henry F. Ashurst, of Arizona, chairman of the very Judiciary Committee which would have to handle the legislation, spoke over the radio just a few nights before.

"In all tyrannical governments," he had said, "no monarch, no tyrant, makes any progress whatever unless and until he seizes in his hands the legislative, the executive, and the judicial powers. The first thing a wise, prudent, scheming, subtle monarch in Europe does, if he wants complete control, is to seize legislative, executive, and judicial powers."

* * *

Obviously that sort of thing would not do. The President could not wait for more of the same, especially as many other senators and members of the House might easily and with some justification ASSUME that Mr. Ashurst KNEW what was in the President's mind on such things—Mr. Ashurst being chairman of the Judiciary Committee: Also, the Ashhurst blast—and there were a few minor ones as well—might be taken by many Democrats as a perfect alibi in explaining to their constituents just why Mr. Roosevelt was NOT a dictator.

* * *

This forcing of the President's hand, plus his own desire to maintain absolute secrecy until his formula for getting around the Supreme Court should be sprung on the public, turned out rather badly from the New Deal viewpoint. As this is written there is far from the normal certainty that the

FORGOTTEN...SINCE 1919

Here are the insulated steel decked roofs laid on the Cleveland plant buildings of the Industrial Brownhoist Corporation back in 1919, the first roofs of this character ever laid in the United States.

In the 18 years that have elapsed, the Brownhoist roof has been forgotten by its owners... forgotten, as a good roof should be... because it has given constant, trouble-free protection. No leaks. No repairs. No expense.

Forgotten too are the old doubts concerning insulated steel deck construction, for Fenestra Holorib has proved that lightweight steel deck, topped by insulation and waterproofing makes one of the best roofs money can buy. Architects can now specify it as a time-tried construction.

Although unusually light in weight, Holorib's triangular rib construction provides exceptional rigidity. It is laid with speed and ease and may be either clipped or welded directly to the purlins. Thus it often reduces structural steel costs and offers a real savings both in initial expense and in maintenance.

The coupon below will bring interesting details; or send sketch for a definite quotation.

Name_____

Address_____

City_____ State_____

DETROIT STEEL PRODUCTS CO., 2258 E. GRAND BOULEVARD, DETROIT, MICH.

Fenestra HOLORIB
ROOF DECKS FLOOR FORMS

President will get what he wants. In fact the only observers who think he will, contend that he never really wanted as much as he asked for! They say he would be perfectly satisfied with two additional justices.

Even if this was the original intention, which one is permitted to doubt, it marks a very important milestone in the progress of the Roosevelt regime toward complete federal control of industry. It has encouraged Democratic leaders who have been privately skeptical or even hostile right along, but never dared voice their feelings, to come out in the open in their opposition to Roosevelt. It has brought many of the New Deal critics of two years ago, who camouflaged their positions during the political campaign, into open opposition again.

The importance to business is that it indicates from now on every new proposal by the President will be put under the congressional microscope. He has lost the prestige which he enjoyed in 1933, and which he regained as a result of the 1936 election. It has apparently become politically safe to oppose him. Some leaders may even dare to oppose the expected constitutional amendment proposal giving the federal government the power to regulate wages, hours, and working conditions, who before this Supreme Court proposal would not have dared to do so.

But in proposing government reorganization and judicial changes the President has certainly given Congress plenty to talk about—perhaps smoothed the way to pass some things he wants, and to sidetrack some he does not, without too much fuss and feathers.

•

Sayings and Doings

Arc Welding Foundation Announces Prizes

To stimulate intensive study of arc welding, $200,000 will be distributed by the James F. Lincoln Arc Welding Foundation. This sum will go to winners of 446 separate prizes for papers dealing with arc welding as a primary process of manufacture, fabrication, or construction in eleven major divisions of industry.

The principal prize winner will receive not less than $13,700. Other prizes range from $7,500 to $100—the latter sum to be awarded to each of 178 contestants who receive no other prize, but whose papers are adjudged worthy of honorable mention.

In order to assure equal competitive opportunity, similar prizes are offered in the eleven major divisions of industry covered by the contest. These divisions are: Automotive, Aircraft, Railroad, Watercraft, Structural, Furniture and Fixtures, Commercial Welding, Containers, Welderies, Functional Machinery, and Industrial Machinery.

Wide diversification of awards is effected by further dividing each major industry into various sub-classifications. Entrants are required to select in advance the particular sub-classification to which their papers will relate.

When accepted by the Jury of Awards as properly classified, each paper will be in competition, in its particular sub-classification, for five initial prizes established for that group. These are worth, respectively, $700, $500, $300, $200 and $150.

From among these sub-classifications winners, four papers will be selected in each major industry to receive additional prizes of $3,000, $2,000, $1,000 and $800. Thus these 44 semi-finalists will be awarded a total of $74,800.

In addition, the semi-final winners in the various divisions will be considered as possible recipients of the four main prizes. These range from $10,000 to $3,500, with the winner of the Grand Prize receiving not less than $13,700 for his paper.

To participate in this contest, it is necessary that submitted papers describe either the redesign of an existing machine, structure, building or the like so that arc welding may be applied to its manufacture, or that they

HARNISCHFEGER ONE-WRITING PRODUCTION ORDER SYSTEM SPEEDS UP WORK AND PREVENTS COSTLY ERRORS
How BENDIX PRODUCTS CORPORATION ISSUES EFFECTIVE PRODUCTION CONTROL
$9000 a year saved by Ditto for Kroehler Furniture Co.
Eliminating 16 Rewritings of Production Orders
saving $1980 yearly with DITTO
Ditto, Incorporated
Ditto, Incorporated

SEND FOR THESE IMPARTIAL INVESTIGATIONS TELLING HOW PROMINENT MANUFACTURERS INSURE EFFECTIVE *Production Control*

The H. P. Gould Company, impartial management investigators, recently made a number of surveys in the production departments of prominent manufacturers.

Four of the reports resulting from these investigations are shown above. Bendix, Kroehler Furniture, Harnischfeger and Nunn-Bush & Weldon all presented interesting stories of effective production control methods.

Copies of the reports, telling how these companies eliminated many rewritings and speeded up production are available for your inspection without cost or obligation. Simply sign and return the enclosed card.

DITTO, Incorporated
656 S. Oakley Blvd., Chicago, Ill.

Gentlemen: Please send me reports of the impartial Gould Investigations carried on in a number of prominent manufacturing companies. No cost or obligation, of course.

Name---------- Title----------

Firm ----------

Address ----------

City---------- County---------- State----------

DITTO, *Inc.*

656 S. OAKLEY BLVD. . . . CHICAGO, ILLINOIS

describe a design (either in whole or in part) of a machine, structure, building, or the like, not previously made. The descriptions must show a result which was less practical or impossible with other methods of construction.

In the divisions of Commercial Welding and Welderies, however, owners and operators of functioning establishments may enter the competition with papers which describe details for successfully conducting such a business.

Contestants must have papers in duplicate on file with the Secretary of the Foundation, at Cleveland, Ohio, not later than June 1, 1938. Prospective entrants should communicate promptly with Foundation Secretary A. F. Davis, P. O. Box 5728, Cleveland, for complete details of the rules and conditions covering awards.

●

Buildings of Glass

Predicting glittering skyscrapers with exteriors of plate and structural glass, from street level to their pinnacles, H. M. Alexander, architectural engineer and head of the Libbey-Owens-Ford Glass Company's New Uses and Design Department, recently described a practical but picturesque architectural future for this country in the use of new types of flat glass.

An important trend, Mr. Alexander stated, is that structural glass now is in demand for exterior facing on new buildings and in modernization of outmoded fronts.

"The color of modern structural glass is not merely reflected from the surface of the glass, but from innumerable depths throughout the glass," Mr. Alexander said. "If you were to look at a piece of structural glass under a microscope it would have an appearance similar to an infinite pool of colored liquid." It may be surfaced with any of the finishes applied to ordinary glass—acid-etching, sand-blasting, or inlay with other colored class. It is available in 10 solid colors and 5 agate shades.

"The last 5 years have seen remarkable advances in the use of structural glass," Mr. Alexander continued. "The next 5 years will see a greater advance. Our research department and engineers are continually working on new developments in the structural glass field.

"In the future, with the perfection of glass-faced light-weight cast stone and other developments, it is reasonable to expect to see skyscrapers whose exteriors are entirely made up of plate and structural glass.

"Through the use of a luminous medium buildings can be made to 'give off' light—not reflect it—resulting in better night advertising, greater eye appeal, and more vivid designs."

●

Open House at Defiance

To give all customers, suppliers, and old friends an opportunity to inspect the Defiance Pressed Steel Company's new plant and facilities at Marion, Ohio, for producing metal stampings and complete welded assemblies, H. F. Hadley, Vice-President, held "Open House" for three days in February.

Invitations were extended to over 2,000 executives connected with metal trades, automotive, dairy, brewery and machinery industries. Every department was in full production during the visits.

●

Hell and High Water

Among the many companies which literally rolled up their sleeves and took up the job of aiding the homeless during the recent flood, the Cincinnati Milling Machine and the Cincinnati Grinders, Inc., stands out for its prompt and unselfish service.

The following steps in connection with the establishment of Unit No. 8 of the American Red Cross in Cincinnati detail dramatically the public spirited work of this concern:

1. A complete Red Cross Unit was set up to take care of refugees. By 8 o'clock in the evening of the day on which the work was started, cots were assembled in the show room, and by

The Key to Immediate Steel

● The Ryerson Stock List is your guide to the largest and most diversified stocks of steel in the country. It shows sizes, weights, extras and other information useful to the steel buyer. In it you are sure to find the kind and quality of material best suited to your needs. And the Ryerson organization will cut, form or do whatever is required and deliver the steel and allied products in record time.

There is a special edition for each of the ten Ryerson plants. The book featuring the stocks of our plant nearest you will be mailed shortly. If you do not receive it in a few days, please let us hear from you.

JOSEPH T. RYERSON & SON, INC.
Chicago, Milwaukee, St. Louis, Cleveland, Detroit, Cincinnati, Buffalo, Boston, Philadelphia, Jersey City

RYERSON STEEL-SERVICE

10 o'clock some refugees were already being cared for. Three days later their number had grown to approximately two hundred.

2. The conference room on the second floor was used as a clothing and a storage room. The plant's centerless demonstration department on the second floor was used for setting up a medical department and a library where the children could obtain books and games.

3. A barber shop was set up for the refugees.

4. A complete power-operated laundry was installed for washing all of the clothing for the refugees, and in addition the company did the washing for three hospitals.

5. A total of 97 boats was manufactured for the boat division of the Central Red Cross.

6. The company is fortunate enough in having a number of artesian wells. Because of the water shortage in Cincinnati, special outlets were provided at three points on the outside of the building where people in the community and the company's own employees could obtain water. At another part of the plant, special tanks, bottles and other receptacles brought there by hospitals, hotels and the like were filled. The company also made up ten large welded sheet metal tanks holding approximately 500 gal. of water and delivered them to surrounding communities. In addition, water was supplied to the city of Cincinnati by tapping in on one of the mains.

7. A bathtub was set up in the girls' washroom, and a shower provided for the men in the main washroom on the third floor. Schedules of baths had been worked out so that everybody who wanted to could take advantage of this opportunity to clean up.

•

Employee Education at IBM

About 50 per cent of the approximately 9,500 IBM employees received some form of instruction in 1936 under the company's world-wide policy of employee education. Although these activities center in its schoolhouse at the Endicott, N. Y., plant, the company conducted 98 different schools in the United States and abroad, with a total enrollment of 4,727 men and women.

At Endicott, fifty-eight courses were opened to enrollment by factory employees, including an apprentice course and a student engineer's course.

•

Accidents Up 10%

The National Safety Council states that accidents, sucked along in the wake of a nation rising from the depths of depression, killed 111,000 persons in 1936 and cost Americans about $3,750,000,000. Both figures are all-time high totals. However, occupational accident deaths in 1936 were but half as numerous as in 1913, when organized safety work began. Reductions in accident frequency and severity rates since 1913 has saved about 265,000 lives and effected a further saving of $3,700,000,000 to employers, workers, their dependents, and the general public.

Tornadoes, floods, excessive heat, increased employment, and a sharp jump in motor vehicle travel were indicted for the increase which wiped out the previous record of 101,139 set in 1934.

In addition to deaths, the Council said, about 400,000 were permanently disabled by accidents last year and 10,300,000 temporarily disabled.

The country's bill for recklessly and carelessly "stubbing its toe" was broken down into $2,630,000,000 in wage loss and medical expense, $830,000,000 for property damage resulting from motor vehicle accidents, and $290,000,000 for fire loss.

While accident totals increased in every phase of human activity, the Council pointed out that the increased totals were accompanied by even larger jumps in "exposure" to accidents, "leaving solid ground for belief that when the country once more is definitely on the high road of prosperity

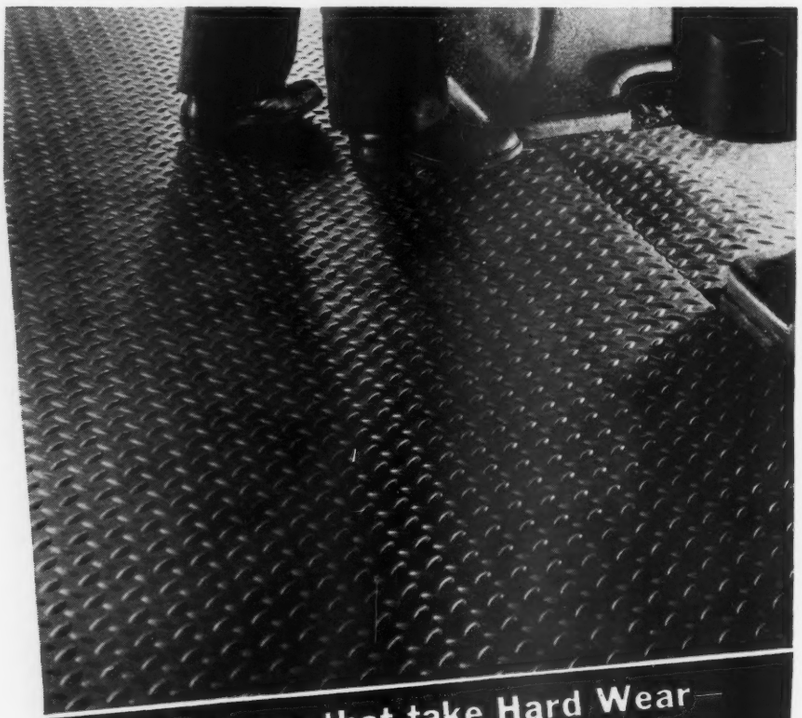
WHY
DIDN'T WE
THINK OF THIS BEFORE?
Once you equip a man with a Zip-Lift, he'll wonder how he ever got along without it! But remember that men toted heavy loads on their backs for centuries, before some wise bird invented the wheelbarrow. The Zip-Lift means an end to strain and fatigue in machine shops. It saves time—increases production.
Paid for Itself in Eighty Days
By installing a simple jib crane between two machine tools, this Zip-Lift served two operators—stepped up production on both machines and saved enough time and money at ordinary shop rates to pay for itself 4½ times in one year. . . . The Zip-Lift is easy to install. It's easy to use and so low in price it makes hand-operated equipment obsolete. Ask us to send you a copy of Bulletin H-2.
HARNISCHFEGER CORPORATION
Established 1884
4525 W. National Ave., Milwaukee, Wisconsin
Paid for Itself in 80 Days
The Zip-Lift stops waste with "Spot Handling"
HARNISCHFEGER
CORPORATION
HOISTS • ELECTRIC CRANES
P&H SERVICE
MOTORS • ARC WELDERS • EXCAVATORS

with employment and automobile travel at fairly constant levels, the accident totals will shrink rapidly in the face of intelligent safety work."

Deaths due to occupational accidents were up 9 per cent to 18,000, from 16,500 in 1935. The Council commented that the increase was smaller than the increase in general employment which exposed additional millions to the hazards of machinery, tools, and the other implements of gainful employment in factories, on farms, in offices, and elsewhere.

Occupational accidents added 70,000 permanent disability cases to their death total and 1,460,000 temporary disability cases, compared to respective totals for 1935 of 63,000 and 1,340,000. These injuries resulted in a wage loss of $510,000,000 and medical expense billed at $45,000,000. In addition, the overhead cost of providing liability and workmen's compensation insurance amounted to about $105,000,000. The 3-item total was $50,000,000 larger than in 1935.

The Council said that industrial plants which reported accident experience to it reduced their number of accidents per one million man-hours, 10 per cent from 1935 to 1936.



YOU have to think of safety and economy, too, when installing floors. Inland 4-Way Floor Plate is industry's most successful answer to both needs.

You'll find it standard among leading firms... after thorough testing of all types of flooring.

You'll find it around machines, on steps, walkways, loading platforms and aisles where wheel or foot traffic is heaviest in all types of plants.

Inland originated the 4-Way Pattern for extra safety in all directions, extra stiffness, easy matching and cleaning. Write for an illustrated booklet on safer industrial floors.

INLAND STEEL

SHEETS • STRIP • TIN PLATE • BARS • PLATES • STRUCTURALS • PILING • RAILS AND ACCESSORIES

INLAND STEEL CO.

General Offices: 38 South Dearborn Street, Chicago, Illinois • Offices in: Detroit Kansas City Milwaukee St. Louis St. Paul

Planned Maintenance

"Show me a concern with a good maintenance department and I will show you a company that makes money. Good maintenance means a good plant, a better place in which to work, and better workmen to produce a better product. Show me a company with run-down buildings and equipment, dirty shop, and a group of workmen who are negligent, and I will show you a failure or a plant which will fail. I will show you a company that our bankers are not interested in and consider a poor financial risk."

"Maintenance cost must be figured in the cost of the product. If maintenance is neglected, true costs are neglected and eventually larger bills and higher costs result. Therefore, the maintenance department is no longer the expense department, but it is the cost-saving department."

"All of our standard maintenance work is done under the group incentive wage system. This has been going on for a number of years and we are safe in estimating that with the incentive system we are saving approximately 15 per cent of our former costs."

"I have never seen a cost that was too low. Every cost is too high. We have heard from our managers, engineers, economists, sales managers and our customers that the costs must be reduced and I do not know of anything that we have all worked harder on or will have to work harder on, than to continue to reduce not only manufacturing costs, but maintenance costs."—*From an address before the Conference Course on Plant Engineering and Maintenance, Armour Institute of Technology, Chicago, by E. C. Brandt, Sales Manager, Renewal Parts and Service, Westinghouse Electric & Mfg. Co.*

•

State Funds to Assist Industry

A proposal for state governmental assistance to private industry, as a means of increasing employment and lessening relief costs, was made by Governor Francis P. Murphy of New Hampshire in his recent inaugural address. The suggestion is to use part of the funds hitherto provided for relief.

Outlining his plan, Governor Murphy declared, "If it is proper, as we agree it is, for the state of New Hampshire to take part in direct relief operations and to spend $1,200,000 in the course of a single year in reimbursing local communities for a part of their expenditures for this purpose, it is just as proper and just as necessary for the state to contribute to the assistance of private industry wherever such action would provide employment and take people off relief rolls.

"If we take a portion of this money that we are committed to spend on direct relief and use it, in the form of self-liquidating loans, to sustain or de-

velop opportunities in private industry, in the very same communities where the state is now contributing heavily to relief costs, we shall be creating permanent values. Operating in this manner, we shall be able to regain a great portion if not the entire amount loaned. But even if none of these loans were repaid the financial burden on the state would not be greater than it is at present.

"I have spoken of these matters in some detail because I desire, if it is legally possible, to have the state undertake industrial rehabilitation as a part of its relief program. For this purpose, a measure embodying my ideas has been prepared and will be introduced soon.

"Under the provisions of this proposed law, no appropriation is required, authority being conferred to use for the purpose of assisting industry not more than 50 per cent of any funds which may be allocated for relief. It would actually be a part of the relief program. In every instance, the test of eligibility for a loan would be, first, the beneficial effect on relief and the creation of employment and, second, the inability of the borrower to secure funds through the ordinary banking channels.

"It is most desirable that prior to taking any action on this measure steps be taken to ascertain its constitutionality. Accordingly, I suggest that arrangements be made with the least possible delay to transmit its text to the Supreme Court with a request for its opinion."

•

Ten Points on Public Relations

1. Know your company, its people and products, and believe in them.

2. Help your company mold sound, sincere public relation policies.

3. Be an interpreter of facts and make them clear and understandable to everyone.

4. Apply your knowledge of accepted methods of advertising and publicity so that wholesome information may be widely spread.

5. Be sure all your fellow-workers know how your products are made and how they are sold.

6. Know the corporate family as a group of fellow workers of whom you are a part.

7. Know about safety and all improvement programs, and help put them over.

8. Radiate enthusiasm and energy, and faith in American Business.

9. Be civic minded and help your company share in all worthwhile community activities.

10. Be a "modern frontiersman"; blaze the way to better and happier living.

—Bennett Chapple, V. P. American Rolling Mill Company.

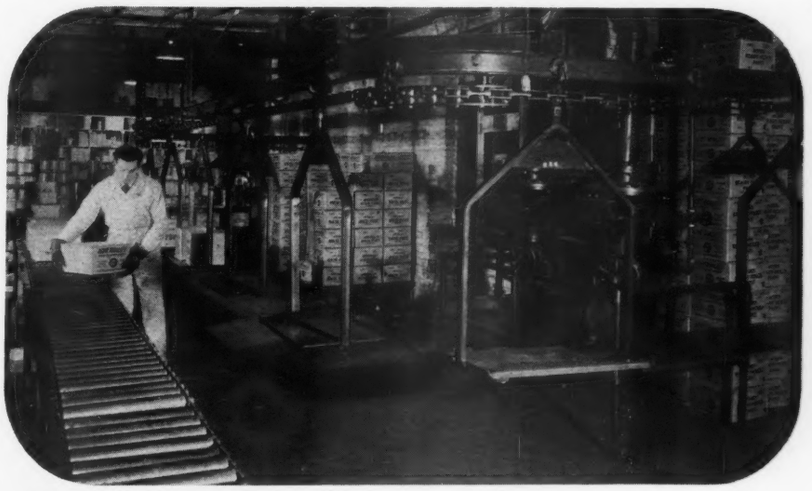
Taxes Reported Highest in Country's History

Taxes in the United States now amount to an average of $100 a year for every man, woman and child in the nation. This is the highest in the country's entire history, and yet at the present time an additional $15 to $20 a person would be needed if borrowing were ended and expenditures undiminished.

These are findings by the Twentieth Century Fund. A complete research report, to be published later, is planned "to give the general public a working knowledge of what the present tax system is and how the various forms of taxation fulfill the tests which can be applied to them." This study will be followed by recommendations as to what should be done to improve the tax system and its various parts in the interest of the national welfare.

The Fund's specialists report that the largest portion is for the federal government—44 cents on each tax dollar or an average of $44 annually for each person in the nation. But the local governments collect an average of $36 a year from every individual, while the state government's share is the remaining 20 cents on each dollar, or $20 annually.

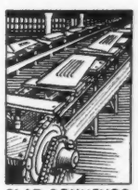
Thus, taking federal, state, and local

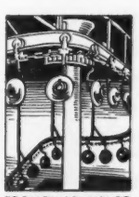


Muscle Power won't reduce costs . . . nor raise labor's living standards

A STRONG MAN can generate continuously about 1/13 kilowatt. At a wage scale as low as 25c per hour, power from human muscles costs $3.25 per kilowatt hour. At 50c per hour, $6.50 • When you use men to move material, you are using them for power, not skill. • Muscle handling keeps costs up—reduces sales volume, profits, dividends, wage scales, and volume of employment. • Mechanical handling reduces costs, *increases* sales volume, wage scales, dividends, and volume of employment. • You want the best mechanical handling. • For many years, Jervis B. Webb has been meeting this need in a wide variety of industries. We offer any type of conveyor needed, and our engineers are skilled in combining them for greatest cost reduction.

BELT CONVEYOR


SLAT CONVEYOR

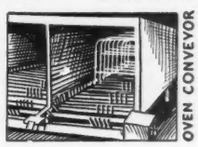

TROLLEY CONVEYOR

JERVIS B. WEBB COMPANY

Conveyor Engineers and Manufacturers

9001 Alpine Avenue • DETROIT, MICHIGAN

CHAIN CONVEYOR


OVEN CONVEYOR

GRAVITY CONVEYOR

Steelcrete

EXPANDED METAL *is easily* FABRICATED *into many* USEFUL PRODUCTS

Free from Burrs and Sharp Edges

● Hundreds of useful products are easily fabricated from Steelcrete Expanded Metal—the diamond mesh that is cut from solid steel; that has the strength of solid steel and that is yet light in weight and easily shaped. Guards for windows, skylights, trucks and machinery; lockers, baskets, shelving, trays, display racks, tool rooms and other enclosures, are all efficiently and economically produced with Steelcrete Expanded Metal, free from burrs and sharp edges. Write for illustrated literature.

Also ask for special catalog covering Steelcrete Expanded Metal Fence made for industrial, property and residential enclosures.

THE CONSOLIDATED EXPANDED METAL COMPANIES
WHEELING, WEST VIRGINIA
Branch Offices and Warehouses: New York Chicago Cleveland Pittsburgh Philadelphia Boston Buffalo Houston Atlanta
Export Office: 330 West 42nd St., New York, N. Y.

systems together "more than one-fifth of what statisticians call the national income is used to pay taxes" the report declares. "And the tax money, when it is paid out in government expenditures, in turn accounts for more than one-fifth of the national income. The fraction would be close to one-fourth however, if borrowing were to be replaced by an increase in taxes." But, the experts warn, these ratios cannot safely be cited in argument either for or against the existing tax system without taking various supplementary factors into account.

Although some persons of course pay much less than the average of $100 a year, "directly or indirectly every individual pays something, for if he does not pay directly to the government, he at least helps others pay through increased rent and prices for food, clothing, and other necessities of life."

The first volume of the research report, comprising a book of over 600 pages, will be released shortly for public distribution. Meanwhile, in a series of meetings which began in October, the special committee is formulating its conclusions and specific recommendations.

•

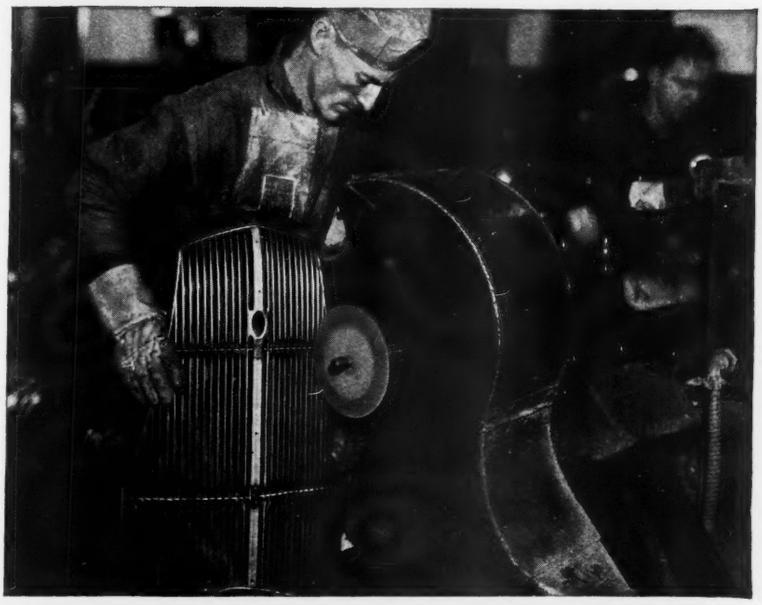
Industrial Color Service

Formation of an Industrial and Transportation Color Service, under the direction of Mr. R. H. Hookway, has just been announced by the Sherwin-Williams Company, Cleveland. This new department combines its efforts with those of the Sherwin-Williams Paint Engineering Service to offer designers, manufacturers and industrial consultants assistance not only in developing desired colors and color combinations for "dressing up" new or old products, but also gives information on types of finishes and their suitability for specific application requirements. The service applies to all types of industry and transportation to aid industrial designers and engineers in securing effective color treatments and suitable types of finishing materials. After the color scheme has been worked out, panels and paint-out tests are made on the material to be finished, to assure the desired qualities, namely, durability, degree of gloss, and color retention.

•

Porcelain Enamelers Announce Conference

Preliminary plans have been announced for holding an "Enamelers' Round Table Conference," sponsored by the Porcelain Enamel Institute, to be held next May at the University of Illinois. F. E. Hodek, Jr., of the General Porcelain Enameling & Manufacturing Company, who is vice-president of the institute, is in charge of



"Lowest Cost per Piece Polished" Depends on 4 IMPORTANT FACTORS . . .

1. Correct Grain Size
2. Correct Grain Shape
3. Correct Grain Strength
4. Correct Grain Surface

Alundum Abrasive is correct in all four factors. Scientific research has determined what they are; modern manufacturing processes and equipment assure their uniform production.

No matter what your polishing jobs may be—fine finishing or heavy duty roughing—you can be sure that Alundum Abrasive will give you lowest polishing costs per piece.

NORTON COMPANY
WORCESTER, MASS.

New York Chicago Detroit
Philadelphia Pittsburgh Hartford
Cleveland Hamilton, Ont.
London Paris Corsico, Italy
Wesseling, Germany

G-45

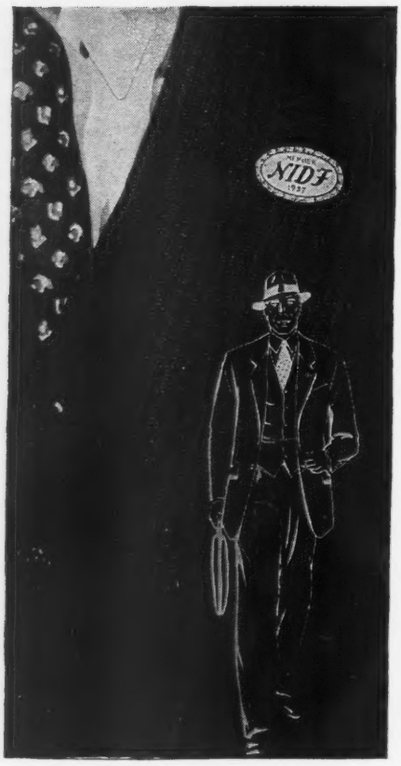
NORTON ABRASIVES

Welcome the Man
...who wears THIS PIN

MEMBER NIDF 1937

He can save you work, worry, money

THIS EMBLEM is the official identification of the National Industrial Distributors' Foundation . . . an organization formed by leading industrial distributors who seek to promote highest standards of service to Industry. Every member possesses recognized ability, and verified facilities for rendering a complete service.



The man who wears this Emblem represents a local member distributor. He warrants a welcome. He places at your command facilities which he maintains as a "cooperative service" for you and other users of industrial supplies and equipment . . . facilities which you can share with other buyers to avoid work, worry and expense in purchasing and stocking the bulk of your plant requirements.

He offers you the advantages of: 1. Expert buying service that "narrows-down" your work of selecting supplies. 2. Superior warehousing facilities that enable you to limit plant stocks, and reduce stock-carrying charges. 3. To-your-door delivery that cuts down shipping and trucking expense. 4. One-source supply which enables you to obtain many items with a single order. 5. An information service that gives you latest unbiased product-and-price data without bother or delay.

While you may know this distributor, now, and use his service to some extent, it will pay you to get-together with him and plan ways to make FULL use of his money-saving facilities.

NATIONAL INDUSTRIAL DISTRIBUTORS' FOUNDATION

Of the Industrial Supply Research Bureau, 7th & Bainbridge Sts., Richmond, Va.; an activity of the National Supply & Machinery Distributors Assn.; Southern Supply & Machinery Distributors Assn.; and American Supply & Machinery Mfrs. Assn.

this new project which is planned to become an annual affair.

According to the initial announcement the conference will be a three-day affair and will include discussions of enameling problems of interest to the entire industry. In addition to the general sessions, which will be all-industry round table discussions, the conference will be divided into sectional groups which will discuss problems pertaining to the enameling of cast iron, sheet metal, and hollow ware. Prof. R. M. King of Ohio State University and Dr. A. I. Andrews of the University of Illinois will take prominent parts at the meetings.

Enamelers' forums and short courses formerly conducted by Ohio State University, the University of Illinois, and the Ferro Enamel Corporation are to be discontinued in favor of this Institute conference.

•

Labor Laws in Great Britain

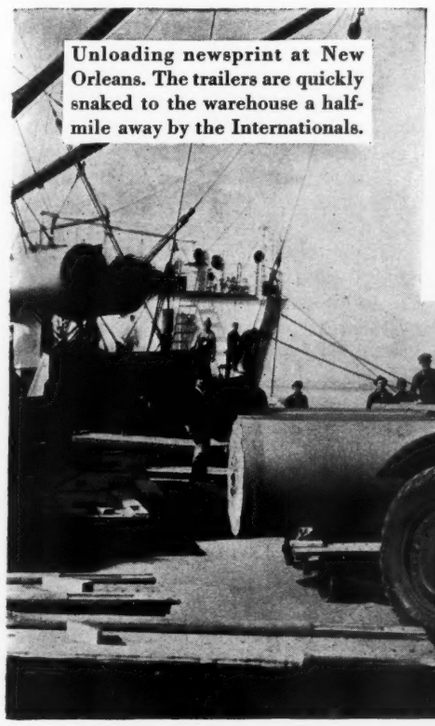
(Continued from page 36)

•

of the five classes of prohibited acts. For example, it is not every persistent following of a person that is made a criminal offense, but a persistent following to compel a person to abstain from doing or to do an act which that person has a legal right to do, or abstain from doing, providing such following would constitute a nuisance at common law for which a private suit might be brought.

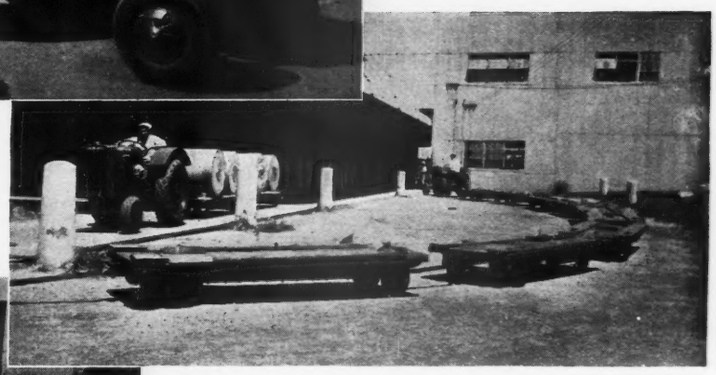
Picketing

It is to be noticed that the last paragraph of this section permits picketing which is directed merely toward obtaining or giving information. In 1906 this paragraph was repealed, and peaceful picketing was expressly declared lawful where in furtherance of a trade dispute and for the purpose of obtaining or giving information or persuading any person to work or abstain from working. In 1927 the picketing provisions were further amended so as to make picketing for the above purposes unlawful where the person or persons attend in such numbers or act in such a manner as to be calculated to intimidate any person in the house or place being picketed, or to obstruct entrance to the house, or to lead to a breach of the peace. "To intimidate" is defined "to cause in the mind of a person a reasonable apprehension of injury to him or to any member of his family or to any of his dependents or of violence or damage to any person or property." "Injury" includes injury to one's



Unloading newsprint at New Orleans. The trailers are quickly snaked to the warehouse a half-mile away by the Internationals.

17 International Tractors to This Firm to Cut Costs and Speed Up Their Stevedoring



Right: One International going to the warehouse passes another on its way to the ship with a string of "empties."

Below: An International hauling 24 sacks of rice to the warehouse.

● In June, 1935, following a demonstration, the Ryan Stevedoring Company modernized its operations overnight at the Port of New Orleans by purchasing five International I-12 Industrial Tractors to haul trailer-trains between shipside and warehouse.

Accurate records soon confirmed the fact that these tractors stepped up efficiency and reduced costs loading and unloading ships. More cargo was moved per hour at a substantially lower cost per ton. The Ryan Company was so satisfied that they have since installed 12 more Model I-12's—another at New Orleans, two at Mobile, one at Panama City, six at New York, and two in Puerto Rico.

Newsprint is typical of the cargo these tractors handle. A train of this usually consists of six trailers, a total load of 17,000 to 19,000 pounds. In one instance, five of the tractors unloaded a cargo of 5864 tons of newsprint in 58 working hours. The hourly gasoline consumption per tractor averaged *only half a gallon.* The total cost per ton, *unloaded and stored, including operators' wages, was 3.37 cents.*

The work the International I-12 is doing for the Ryan Company is proof of its ability to handle your jobs efficiently and economically. See the nearby Company-owned branch, or industrial dealer for complete information. The International line also includes other wheel-type tractors and crawler tractors, and power units for stationary work ranging up to 110 max. h. p. in size.

INTERNATIONAL HARVESTER COMPANY
606 So. Michigan Ave. (INCORPORATED) Chicago, Illinois

INTERNATIONAL Industrial Power

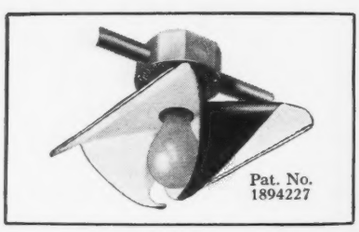
—Says
SUNNY LUMENS
the Goodrich Man

"Do your stock clerks spend their lives in the murky gloom? . . . fishing into dark bins? . . . squinting to identify parts numbers? . . . moving from dark to light to read their orders? Now, it costs but a trifle to correct this bad situation with this revolutionary new reflector, designed specifically for use in narrow aisles."

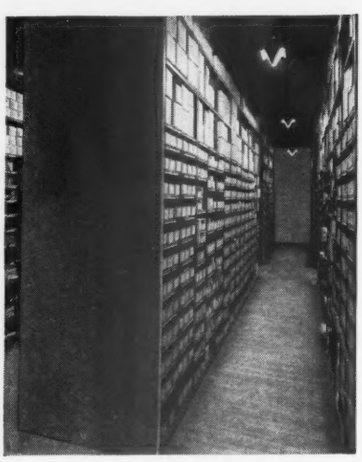
THE STOCKLITE

A Radical Improvement in Stock Bin Illumination

Makes it possible to read labels, numbers, typewritten slips, etc., anywhere in stock bin aisles. Delivers a high intensity of light, properly diffused, from top to bottom shelf and on shelf surfaces. Eliminates glare—speeds handling.



THIS ODD SHAPE DOES IT!
Note how this reflector directs light to the sides—how the curved V-shaped flange eliminates aisle glare—how it uses the lamp's full efficiency. Vitrified enamel finish insures lifetime service. An exclusive Goodrich product.



ASK YOUR ELECTRICAL SUPPLIER OR WRITE US FOR FOLDER

GOODRICH
ELECTRIC COMPANY
OFFICES IN ALL PRINCIPAL CITIES

GENERAL OFFICES AND FACTORY: 2904 N. OAKLEY AVENUE, CHICAGO, ILL.

business, employment or other source of income.

Expenditures for Political Objects

Trade union funds may not be expended in furtherance of the political objects described below unless the furtherance of these objects has been approved by ballot as an object of the union by a majority of the union members voting on the matter and unless rules approved by the Registrar of Friendly Societies are in effect providing:

(1) That any payments in furtherance of such objects are to be made out of a separate fund (the political fund);

(2) That all contributions from members to the political fund of the union shall be levied and made separately from any contributions to other union funds;

(3) That members who are not obligated to contribute to the political fund are not to be placed at any disadvantage as compared with contributing members;

(4) That contributions to the political fund of the union shall not be made a condition for admission to the union.

To be exempt from contribution to the union's political fund, it was necessary, between 1913 and 1927, for the member to "contract out." That is, he was required to give a written notice to the union that he objected to making such a contribution. The act of 1927 changed this to provide that a member was to be liable only when he had contracted in, that is, had given a written notice of his willingness to contribute.

The 1927 Act also requires unregistered trade unions, which theretofore were not required to make any annual reports to the Registrar of Friendly Societies, to make an annual report to that officer so far as respects the receipts, expenditures, assets and liabilities of the union's political fund. Failure to make the required return subjects both the union and its officers to penalties.

Section 3 (3) of the Trade Unions Act of 1913 defines "political objects" as follows:

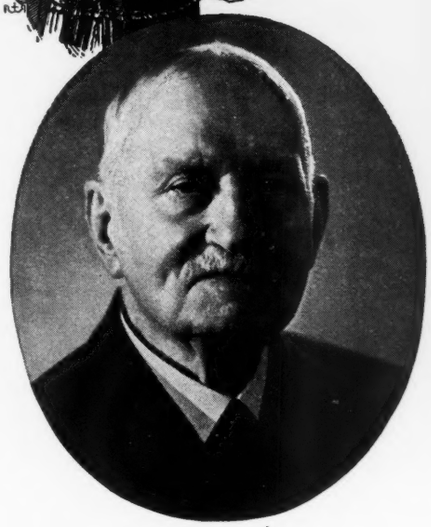
The political objects to which this section applies are the expenditure of money—

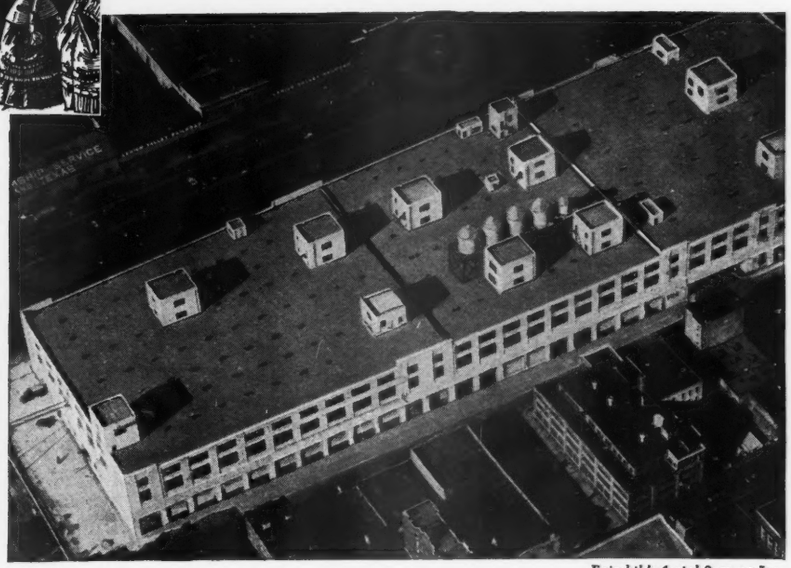
(a) on the payment of any expenses incurred either directly or indirectly by a candidate or prospective candidate for election to Parliament or to any public office, before, during, or after the election in connection with his candidature or election; or

(b) on the holding of any meeting or the distribution of any literature or

AN OLD LANDMARK PASSES —A ROOF RECORD IS MADE

1868-1936 Built during Andrew Johnson's administration, New York Central's St. John's Park Terminal and Warehouse, New York City, was designed to be one of America's greatest terminals. Today, after 68 years of service, the building is being razed, but the Barrett Roof, laid just three years after the close of the Civil War, is still in excellent condition.





Fairchild Aerial Surveys Inc.

1934 . . . ? The new St. John's Park Terminal of the New York Central Railroad, built in 1934, replaces the old terminal now being demolished. The new building also has a Barrett Coal-tar Pitch and Felt Roof. 1868 to 1936 gives New York Central engineers an idea of what to expect of the new roof from 1934 to 2002.

NINETY-TWO-YEAR-OLD L. W. Harrington was a young man of 24 when he supervised the application of a Barrett Roof on the original St. John's Park Terminal and Warehouse. Says Mr. Harrington. "When this building was built Commodore Vanderbilt was alive and was proud of the station he was about to build. Barnes and New had the contract for the roofing and before the work started the Commodore called Mr. New into his office and told him he was building the best depot in the world, and wanted the best roof put on that could possibly be made. We took the Commodore at his word, and applied a Barrett Coal-tar Pitch and Felt and Gravel Roof. After 68 years, I would say that the roof is in almost perfect condition. After 68 years of personal use of coal-tar felts and pitches, I unqualifiedly say that they are the best materials I know for roofing and waterproofing."

TIME gives proof of roof performance. It is not unusual for Barrett Roofs to outlive the useful lives of the buildings on which they are placed. There are hundreds of Barrett Coal-tar Pitch and Felt Roofs giving 100% satisfaction after 40 to 50 years of hard service. These records, unique in the built-up roofing industry, point the way for building owners who want complete and lasting freedom from roof worries.

Barrett ROOFS

THE BARRETT COMPANY

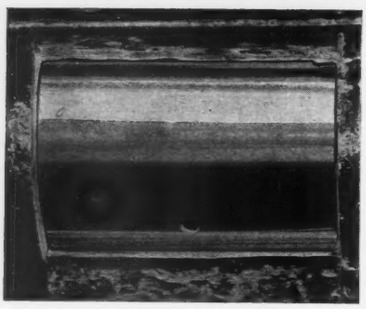
40 Rector Street, New York, N. Y.

2800 So. Sacramento Avenue, Chicago, Illinois — Birmingham, Alabama

Barrett Specification Roofs, bonded for 20 years by the United States Fidelity and Guaranty Company, are applied by Barrett Approved Roofers. Look for the nearest Barrett Approved Roofer in the Classified Telephone Directory under "Roofers."

The
LUBRIPLATE FILM
Published In the interest of better lubrication

A TOUGH JOB



LUBRIPLATE lubricants reduced maintenance to an all time low and speeded up production on these heavy duty toggle presses in large asbestos products plant.

•

Note mirror finish on toggle joint bearing which is made of special steel and carries a load of 25,000 pounds per square inch.

•

There is no lubrication job too tough for LUBRIPLATE. Write for complete data explaining how LUBRIPLATE lubricants reduce wear, power consumption and upkeep costs.

"For the Finest"
PREVENTS WEAR — CORROSION
LUBRIPLATE
SUPER-LUBRICATION

LUBRIPLATE DIVISION
FISKE BROTHERS REFINING CO.
Established 1870
24 State Street, New York, N.Y.
Plants: Newark, N. J. and Toledo, Ohio

documents in support of any such candidate or prospective candidate; or

(c) on the maintenance of any person who is a Member of Parliament or who holds a public office; or

(d) in connection with the registration of electors or the selection of a candidate for Parliament or any public office; or

(e) on the holding of political meetings of any kind, or on the distribution of political literature or political documents of any kind, unless the main purpose of the meetings or the distribution of the literature or documents is the furtherance of statutory objects within the meaning of this Act. (The term "statutory objects" refers to the regulation of the relations between employees and employers, or between employees and employees, or between employers and employers, and the imposition of restrictive conditions on the conduct of any trade or business, and the provision of benefits to members.)

The expression "public office" in this section means the office of member of any county, county borough, district, or parish council, or board of guardians, or of any public body who have power to raise money, either directly or indirectly, by means of a rate.

Restrictions on Registered Unions

The matters that have been discussed above apply both to registered and unregistered trade unions. There are also some restrictions applicable only to registered trade unions.

Registration of a union is effected by application to the Registrar of Friendly Societies. To qualify for registration a union must have rules setting out the objects of the organization, modes of amending the rules, provisions for appointment of officers, etc.—i.e., provisions similar to articles of incorporation.

Registration is wholly voluntary. There are a number of inducements, however, for a union to register. Registered unions or their officers or members stand in a better position than unregistered ones or their officers or members in the following particulars:

(1) A registered union has capacity to take land in the names of its trustees, and to sell, mortgage or lease the same.

(2) Personal property as well as real belonging to a registered trade union is vested in its trustees for the benefit of the union and its members. Upon the death or removal of a trustee the property will vest in his successor trustee without any conveyance or assignment.

(3) Trustees of a registered trade union (or other officers authorized by the union so to do) may bring or defend suits concerning the union's property, in their own names and without other description than the title of their office.

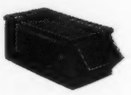
SPEED-UP PRODUCTION

—with A-S-E Stacking Boxes and Stack Units

• A-S-E Stacking Boxes and Stack-Units are helping many manufacturers meet the demands for faster production by providing a quicker, more economical means of handling small parts.

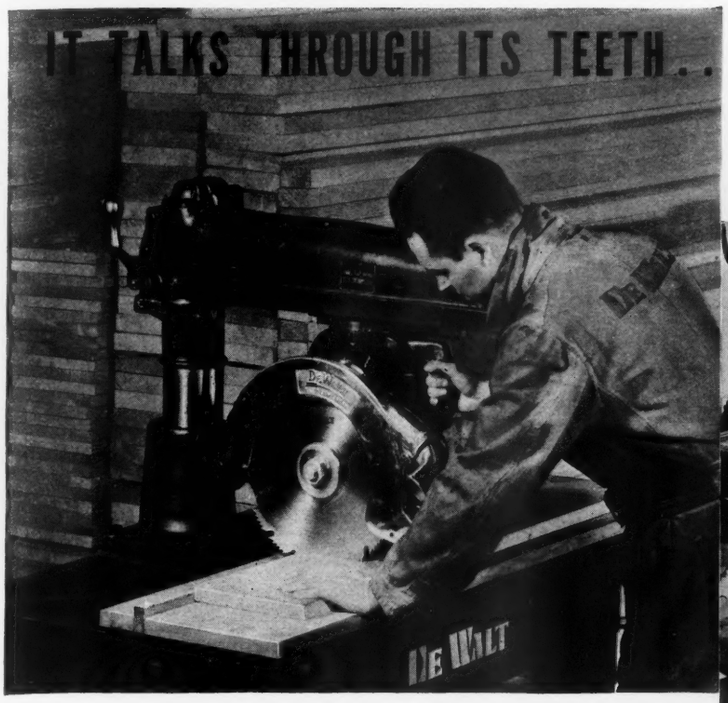
STACKING BOXES The special continuous rim permits absolutely secure stacking to any height. There is no danger, boxes can not telescope or become unstacked by vibration. Floor space is conserved, providing greater inventory economy in storing parts. Built for tough service, they can be used on roller or belt conveyors, picked up by cranes or carried on trucks or skid platforms.

STACK-UNITS have the latest type of sloping bin front, with stacking rim effect *on all four sides.* Can be stacked as high as desired. A-S-E Stack-Units are particularly well adapted for the storage of many small parts and for use in assembly work where parts must be within easy reach, quickly accessible and must not become mixed.



FREE—a sample will be sent to you for inspection or trial. Write for it today. No obligation.

ALL-STEEL-EQUIP COMPANY
INCORPORATED
501 Kensington Ave., Aurora, Illinois



..and tells you how to save and how to MAKE money

IF YOU look at these pictures and say, "Oh, just another machine," you're wrong—**dead wrong!** DE WALT is much more than a flexible mechanism. It's an up-to-the-minute METHOD of merchandising. We'll prove it to you quickly.

Here is a special motor in a special housing, directly driving the cutting tools, and ingeniously suspended on a yoke so that it is quickly adjustable to any position through 360°. The yoke is also adjustable through 360°. And finally, the universal cantilever arm firmly supports the yoke at any point through 360°. Every possible angle and position is quickly adjusted and rigidly fixed so that the DE WALT operates without waste of power, without vibration—with remarkable accuracy. So much for the mechanism itself.

More important to you is the scope of its usefulness suggested in the brief paragraphs below. If you think in terms of saving money and also **making** money, you'll want to see everything DE WALT can do and judge its flexibility, accuracy, ruggedness and safety through actual demonstration. Made by DE WALT PRODUCTS CORPORATION, 600 Fountain Avenue, Lancaster, Pa.

1 SHIPPING Departments find DE WALT faster than anything available for straight cut off and rip work in building crates, cases, boxes, etc. Its speed spells real economy.

2 MAINTENANCE Departments say that in a DE WALT, they have the equivalent of many single purpose machines. In all kinds of plant maintenance work, the DE WALT Woodworker more than pays its way.

3 PATTERN SHOP foremen who have once used a DE WALT and have seen the **accuracy** of its cuts consider this machine indispensable. Wherever it is in use, the variety of operations improve workmanship immeasurably.

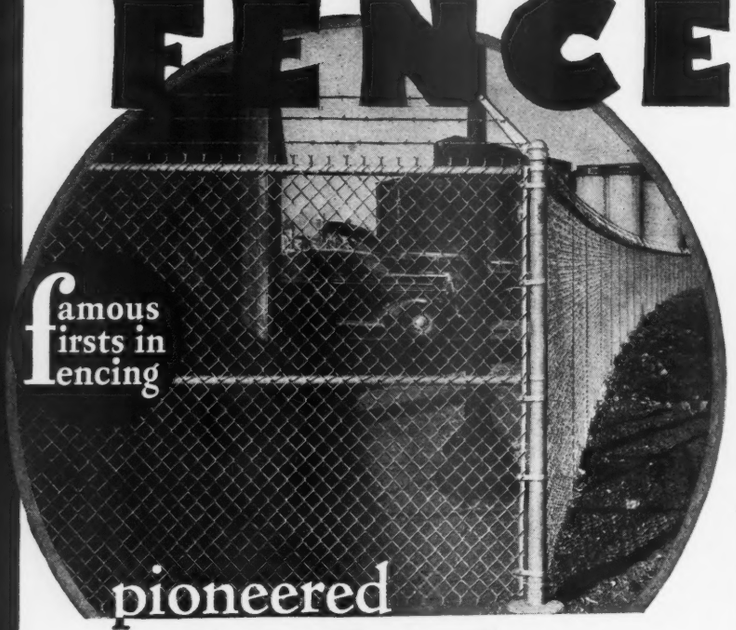
4 PRODUCTION LINE uses for DE WALT are demonstrated almost daily in many industries. Here the rigidity and remarkable accuracy of its operation become indispensable.

DO THIS—

Drop us a brief note or wire. We'll arrange an early date for a demonstration. Not only can you see DE WALT at work but also actual figures on savings and profits it has effected for hundreds of owners. There's no obligation. Do this today—or if you prefer, we will send descriptive literature.

DE WALT
WOODWORKER

PAGE FENCE



pioneered
and perfected

ARMCO

ARMCO INGOT IRON* fencing . . .

PAGE made America's first woven wire fence in 1883 and has pioneered most fence improvements ever since.

With no manufacturing obligation to any *one* metal, PAGE is the only fence consistently identified with the greatest names in metals. Page-Armco Ingot Iron fencing was pioneered and perfected to provide unusual resistance to salt spray, chemical fumes and other conditions harmful to even finest copper-bearing galvanized steel. Its cost has been lowered by Page to but little above that of steel. Coupon brings full details.

***ONE OF 5 SUPERIOR FENCE METALS**

PAGE FENCE is offered in 5 superior metals to meet every condition in fencing—Page P-12 Copper-bearing Steel, Page-Armco Ingot Iron, Page-Alcoa Aluminum, Page-Allegheny Stainless Steel and Page genuine Wrought Iron. All Page P-12 galvanized fence—mesh, fittings, top-rail and new P-12 Wing Channel Line Post—is covered by the 12-dip Preece Test guarantee, the highest known to the industry.

92 Association Members

92 Page Fence Distributors with complete responsibility in fence erection service, estimates and consultation are located conveniently throughout the United States—associated to serve you wherever you are.

FENCE FACTS FREE

Mail coupon below for nearest Page Fence Distributor's name and free copy of new informative booklet "Fence Facts."

Page Fence is a product of the Page Steel & Wire Division of American Chain & Cable Company, Inc.

PAGE FENCE ASSOCIATION

DEPT. F-3, Bridgeport, Connecticut

Please mail me new Free Booklet "Fence Facts" and name of nearest associated Page Fence Distributor.

Name.....

Address.....

City.....*State*.....

AMERICA'S FIRST WIRE FENCE—SINCE 1883

Such actions will not abate because of the trustee's death or removal from office, but the action will be continued by his successor.

(4) The liability of the trustees of a registered trade union is limited by section 10 of the Trade Union Act of 1871, which provides that "a trustee of any trade union registered under this Act shall not be liable to make good any deficiency which may arise or happen in the funds of such trade union, but shall be liable only for the moneys which shall be actually received by him on account of such trade union."

(5) Every treasurer or other officer of a registered trade union, when required to render an account of receipts and expenditures since the last accounting, and of the balance in his hands, and of all bonds and securities of the union, must do so. Such accounts must be audited by a fit person selected by the trustees. The treasurer, if required, must hand over the balance shown to be due by the audit, and may be sued if he fails to do so.

(6) Any person who gains possession of any money or other property of a registered trade union by false representations, or who wilfully withholds or misapplies the union's money or other property, may be proceeded against summarily upon the complaint of any person on behalf of the union, or upon the complaint of the Registrar or the union. The court may order the defendant not only to repay the amounts improperly diverted, etc., but also to pay a further sum not exceeding 20 pounds. A defendant who defaults in making the payments may be imprisoned not to exceed three months.

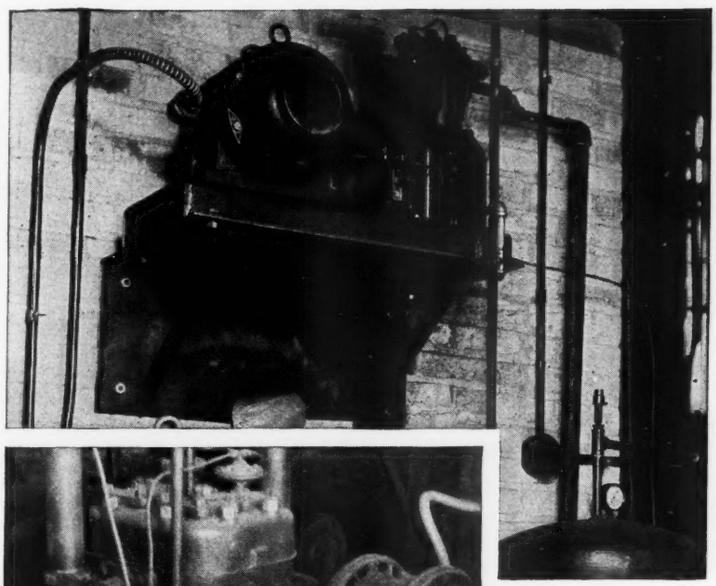
(7) A member of a registered trade union, who is 16 years of age or more, may nominate a person to receive any money not exceeding 100 pounds which might be payable by the union on the member's death. Such a nomination may be revoked by the nominator at any time upon observing the same formalities as are required for the nomination,—i.e., writing and delivery to the union's registered office. This permits the disposal of small sums without the trouble and expense involved in making a will and administering it.

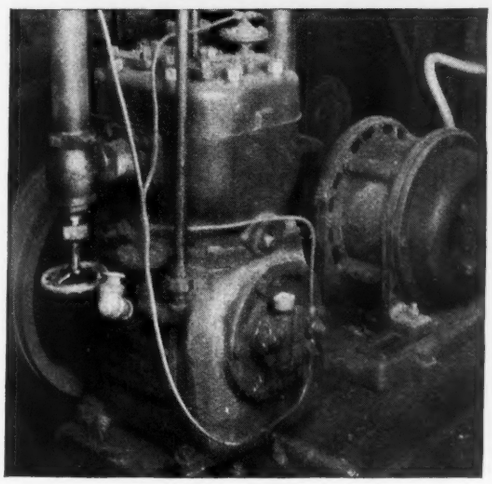
(8) If a member of a registered trade union, who is entitled to receive from the union's funds a sum not exceeding 100 pounds, dies intestate and without having made a nomination, the sum is payable, without letters of administration, to the person selected by the majority of the union's trustees as entitled by law to receive the same.

(9) Registered trade unions are exempt from the provisions of the Assurance Companies Act of 1909. This latter Act imposes various obligations upon insurance companies, such as the requirement that they deposit the sum of 20,000 pounds with the Board of

RESULT-DEMANDING BUYERS

—*get what they want from* QUINCY COMPRESSORS





Above: This Quincy Compressor is used at Mojonnier Bros., Chicago, to supply air at high pressure for operating welding machines. The Mojonnier Company makes equipment for milk distributors.

At left: Special pneumatic machines are used at General Felt Products Co., Chicago, for processing the felt pads that are placed under rugs. This Quincy Compressor is used to supply the air necessary in lifting operations in air cylinders on the pneumatic machines.

OH NO! At least not necessarily, are we referring to the "hard boiled" equipment purchasers who get a kick out of making the salesman's job tougher than it need be. We **do** refer to those positive-minded, two fisted, determined types who **demand** results.

Such buyers virtually explode in the face of alibis. To them, equipment has made good or it hasn't. The "why" doesn't matter.

Quincy salesmen like to face such men because they know Quincy Compressors will back them to the limit through the hardest going and under the most exacting scrutiny. Quincy Compressors deliver lower-cost air through long years of trouble-free performance. **Let us give you the facts.** Complete information will be sent promptly on request.

QUINCY COMPRESSOR CO., QUINCY, ILLINOIS

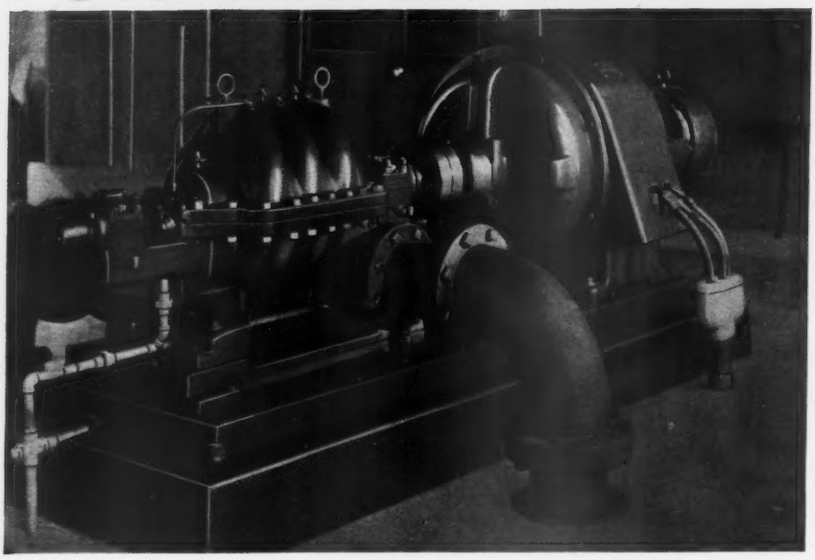
BRANCHES: CHICAGO and NEW YORK

QUINCY FEATURES: Timken Roller Bearings • Semi-Steel Pistons • Balanced Drop-Forged Crankshaft • Non-Breakable Steel Valves • Perfect Circle Piston Rings • Lynite Connecting Rods • Positive Full-Pressure Lubrication • Improved Cooling • Nickel Chrome Castings • Dust-proof Enclosed Crankcase

WHERE AIR IS IMPORTANT

QUINCY Compressors

FOR WATER SUPPLY



Goulds Multi-Stage Centrifugal Pump delivering 700 g.p.m. at 300 ft. head at Hampden Reservoir, Reading, Pa. Hundreds of similar installations in all types of industrial plants are giving efficient trouble-free service.

GOULDS MULTI-STAGE CENTRIFUGAL PUMPS

Because of high efficiency — the result of over half a century devoted to progressive improvement in design — because of fine materials, careful workmanship and durable construction, Goulds Multi-Stage Centrifugal Pumps have set unequalled records for low-cost-per-gallon pumping—for trouble-free service over long periods.

Available in capacities from 40 to 2000 g.p.m. for heads up to 850—feet — in bronze fitted, all iron and all bronze construction — these high efficiency pumps find wide application for general water supply, pressure service, circulating systems, unwatering and many other uses. Write for Bulletin No. 201 giving complete information.

GOULDS LEADERS SINCE 1848 *manufacture pumps for every purpose*

GOULDS PUMPS Inc.
SENECA FALLS N.Y.
ATLANTA BOSTON CHICAGO HOUSTON NEW YORK PHILADELPHIA PITTSBURGH TULSA Representatives in all Principal Cities

7129

Trade, make annual accounts, triennial statements, etc.

Some of the provisions described above are intended to safeguard the rights of trade unions and of their members by permitting criminal prosecution of offenders. Item (6) in the list just given is of this sort, being designed to prevent misuse of union funds and property by union officers.

In addition, the statutes make it a criminal offense for a registered trade union to be in operation for seven days or more without having a registered office to which all communications and notices may be sent. The union and each officer are subject to penalty for each day in which the union is so in operation.

Any person giving false copies of the rules of a registered trade union to any member or intending member of the union, with intent to deceive or defraud, also is guilty of a criminal offense.

Registered unions also are required to make an annual general statement to the Registrar of Friendly Societies. This statement must show the union's assets and liabilities, its receipts and expenditures for the year preceding the date of the report, and shall show separately the expenditures for the union's different objects. Penalties are provided for false statements, and for failure to make the required report.

•

Overhead by Formula

(Continued from page 49)

•

period. It would be perfectly proper, however, to change from one method to the other provided changes were not made during a given period and the same formula were used throughout the period.

It might be well to point out that simple Formula 1 is not often used in a manufacturing enterprise, but is confined mostly to retail and wholesale establishments.

Formulas 2 and 3 are extensively used in manufacturing. Wherever materials play a large part of the prime cost, Formula 2 will result in a low total cost; wherever productive labor plays a large part, Formula 3 will result in a low total cost. Therefore, if one manufacturer uses Formula 2 and his competitors use Formula 3, he will find he is always low on certain products and always high on others, and a comparison of results with his competitive prices will be a great help in determining the proper formula to use. Of course, the ideal

OPEN HIS EYES—

for safety and efficiency—with paint that SPREADS LIGHT!

TEAR away—with light-diffusing paint—the blindfold that endangers factory employees and impairs their efficiency. Working in cooperation with recognized authorities on light and sight, Pittsburgh Paint scientists have perfected three distinct systems of interior finishing that convert raw light into useful light at a minimum cost.

These systems, designed to meet every need of industry and business, employ the famous Glorified Light products to control and spread scientifically all light—either artificial or natural. This is accomplished through the development of products that effect proper diffusion of light in the highest attainable degree.

Our local Pittsburgh representative will be glad to tell you how Glorified Light products can be made to pay you *cash profits* in your plant! Or, send the coupon for our authoritative booklet, "Glorified Light". Address: Pittsburgh Plate Glass Co., Paint Division, Pittsburgh, Pa.

THREE SYSTEMS PRODUCE GLORIFIED LIGHT

Using Glorified Light products, Pittsburgh's three finishing systems offer all types of industry economical utilization of light—result in maximum seeing efficiency.

THE SNOLITE SYSTEM

is a line of superior whites for all *normal interior exposures.* Flat, Satin, Low Eggshell, Standard Eggshell, Semi-Gloss, Gloss. Tints in Satin and Semi-Gloss.

THE SNOTEX SYSTEM

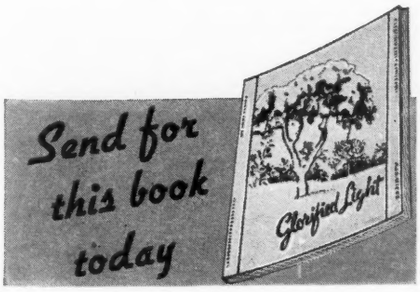
is for all *abnormal interior exposures* except where fungus may be expected. The highest attainable resistance to discoloration in the presence of humidity, fumes, gases, heat or unusual absence of daylight.

THE FUNGUSIDE SYSTEM

is for use *where fungus exists* or may be expected. Of special importance to the food industry and every one who must wage a constant battle against bacteria, mold or other types of fungus.

PITTSBURGH PAINTS
Smooth as Glass

WALLHIDE ★ FLORHIDE ★ WATERSPAR ★ SUN-PROOF



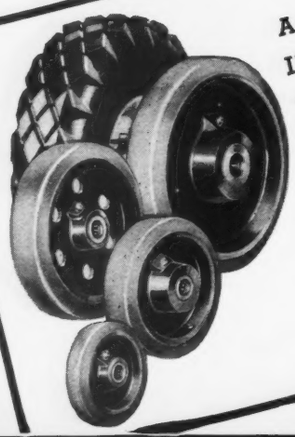
Pittsburgh Plate Glass Co., Paint Division, Dept. FM 3, Pittsburgh, Pa.
Please send me, free, your new book, "Glorified Light".
Name_____
Address_____
City_____ State_____

These books can solve your

Good Hand Trucks Make Payroll Produce Profits

Everyone who buys hand trucks finally learns that profits do not come from the saving in truck prices but rather from the actual "trucking" each man can do day after day. Better trucks—lighter trucks—*easier handled trucks* make it possible for less men to do more work.

American Pressed Steel Hand Trucks are the choice of those big fleet operators whose large investments in payroll require careful selection of equipment. Their sturdy frames of light, tough steel can take any punishment. Models designed for every material handling need are available. Ask your dealer or write for illustrated catalog.



American Tested Rubber-Tired INDUSTRIAL TRUCK WHEELS

These wheels are available for every type of truck—with face and hub dimensions carefully designed for the load to be carried. They eliminate noise in operation and shock to frame and load. They give complete floor protection and trucks equipped with these wheels are as easily operated as trucks equipped with plain tread wheels. Write for catalog illustrating and describing each type.

THE AMERICAN PULLEY COMPANY
Dept. 4, 4200 Wissahickon Ave., Philadelphia, Pa.

AMERICAN PRESSED STEEL HAND TRUCKS

situation is to point out these facts to competitors and endeavor within the industry to set up a uniform method of cost accounting which will result in more uniform prices and fairer competition. Then the efficiency of the particular organizations will be the measuring stick of cost and not the method of applying overhead.

I shall not attempt to point out that there are many methods of applying overhead not mentioned herein and many other means of competitive analysis. This is written purely with the thought of suggesting to the manufacturer that he use an engineering, mathematical formula to solve his problems.

•

Rate Setting with Battery Constant

(Continued from page 40)

•

Gears were being cut for ten different makes of cars, not counting those cut for service sales, and the reduction sought was for a car that comprised about 50 per cent of total daily production.

The gear-cutting department was arranged with the rough-cutting machines in a single line on one side of an aisle, with the finish-cutting machines grouped on the other side. The ratio of rough-cut to finish-cut machines was about one to four, and the rate standards for each had been established by the battery constant method. The operators working as a group made it possible to operate any combination of machines, with any combination of drive gears or with pinion gears, and with any combination of customers. Payment for finished gears was the sum of the separate standards established for rough and finish cutting.

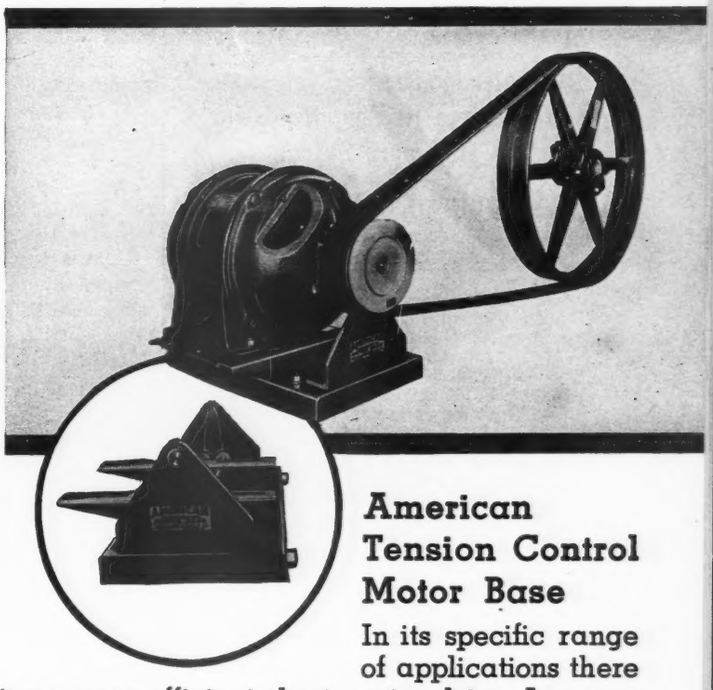
Less than a year before, the entire department had been time studied, the speeds and feeds advanced, and the number of machines operated per man increased to the maximum, so that it looked as if any reduction was improbable. Considering that the reduction we were obliged to make was for 50 per cent of our daily production, we decided to set up a separate battery of machines to rough- and finish-cut the teeth of spiral drive gears, to be operated by one man, making it possible to keep the battery running on one gear continuously. The gear had 41 teeth, and the complete cycle for rough cutting was 8.38 min., and for finish cutting 19.47. This estab-

These books can solve your Short Center Drive Problems

These two booklets are of the greatest significance for anyone whose responsibility it is to *increase* performance and *decrease* costs on short center drives. One covers the engineering of V-Belt installations and the applications of Wedgbelt Drives. The other describes the outstanding characteristics of American Tension Control Motor Base Drives. Every Short Center Drive has its own peculiar characteristics. Each case warrants individual study. Have *all* the facts in hand, on *both* basic methods before making your decision on new equipment.

American Wedgbelt Drives

Better grooving, better balance, better bushings combine to make Wedgbelt Pulleys outstanding in their field. They are offered with the definite intention of providing a superior product, based on this company's two score years of producing quality power transmission products.



American Tension Control Motor Base

In its specific range of applications there is no more efficient short center drive. In many cases it has reduced average belt tensions and bearing pressures 50%—with corresponding reductions in maintenance and replacement costs. Its superiority is a matter of proven engineering fact—its performance can be predetermined with mathematical accuracy.

Send us the facts about any difficult drive. Years of experience in engineering power transmission equipment will enable us to recommend the most efficient type of equipment.

Mail this coupon

The American Pulley Co.
4200 Wissahickon Ave. Dept. 5
Philadelphia, Pa.

☐ Send your Wedgbelt Drive Catalog.
☐ Send your Tension Control Motor Base Catalog.
☐ Your representative will be welcome.

Name _____
Address _____
City _____ State _____

AMERICAN PULLEY COMPANY

Falconer Building, Baltimore, Md.

PRINTING PLANT SOLVES TEMPERATURE PROBLEM

Webster Moderator System Meets Diverse Heating Needs in Baltimore Building

CHANGE TO DISTRICT STEAM

Baltimore, Md.—To meet the diverse heating needs of printer, lithographer and office worker—without interfering with the comfort and efficiency of the others—is the function of the Webster Moderator System in the eight-story Falconer Building.

The Falconer Building is occupied by the Falconer Company, one of the largest producers of bank and commercial stationery in the East. Manufacturing operations include printing, lithographing, steel die stamping and bookbinding. Some of these operations, particularly lithographing and printing, require constant temperatures. As a result of installation of the Webster Moderator System, the needs of all departments have been adequately met.

Before completion of a Webster Heating Modernization Program in 1932 it was impossible to maintain steady temperatures on certain floors without overheating other parts of the building.

With the Webster Moderator System, steam distribution is carefully controlled so that desired temperatures are reached and held in each section of the building. The flexibility and ease of control is facilitated by use of district steam service. The Falconer Company has found purchased steam, when used with the Webster Moderator System, more economical and dependable than private boiler plant operation.

The Webster Moderator System has overcome difficulties that cost the Falconer Company money and continual annoyance. Over a period of four years, the distribution of steam has consistently been satisfactory for their various departments.

Webster traps, valves, orifices, concealed radiation, central heat controls—all are available from one manufacturer under undivided responsibility.

If you are interested in heating *new* buildings, or in improved heating service and lower heating cost in your present building, address WARREN WEBSTER & CO., Camden, N. J. Pioneers of the Vacuum System of Steam Heating Branches in 60 principal U. S. Cities — Estab. 1888

lished a ratio of about two machines for rough cutting to five machines for finish cutting.

Using a scale of 4 min. per in. we laid off and cut out about 15 each of cardboard dummies representing the cycle time (index plus change time) for rough and finish cuts. Each dummy had the change time, 1 min. for rough cutting and 1.84 min. for finish cutting, laid off and marked in colored pencil on the left end. Using a sheet of graph paper ruled to the same scale as the dummies, we manoeuvered the dummies about until we developed the complete sequence of machine operation as indicated in Figure 1, in which the solid black portion represents the change of operator's time; the gray portion, the machine time; the cross hatched portion, the idle machine time. By dropping lines from the operator's change time as indicated in the figure, his idle time can be scaled off and totaled. In the graph, for example, it is 13.4 min. or 31.7 per cent of the 42.2 min. total cycle time. The idle machine time can be determined in the same manner and is 18.65 min. or 6.3 per cent of the total cycle of 295.4 min. for the seven machines.

Comparing the new standard developed by the graph we found we were able to make a reduction of 25 per cent in the former standard. We then laid the drive pinion gear out by the same method, and the final result for both gears was a direct labor saving of $1300 per year.

•

TRADE LITERATURE

(Continued from page 74)

Circuit Breakers—Bulletin GEA-2505, on type AF-1 circuit breakers.—General Electric Co., Schenectady, N. Y.

Circuit Breakers—Bulletin CA-543A, on Multi-Breaker circuit breakers, load centers, and panelboards.—Square D Co., Detroit.

Conveyor—Folder, describing piler conveyors and combination piler conveyors.—Standard Conveyor Co., North St. Paul, Minn.

Dust Collector—Bulletin No. 904, describing electrostatic precipitators.—Pangborn Corp., Hagerstown, Md.

Dust Collector—Bulletin No. 163-1, describing bag-type dust arrester.—The Northern Blower Co., 6409 Barberton Ave., Cleveland.

Dust Collectors—Bulletin DA-6, describing Oval Bag and unit-type dust arresters.—Parsons Engineering Corp., 6511 Cedar Ave., Cleveland.

Electric Tools—Catalog No. 899, covering line of electric tools—Chicago Pneumatic Tool Co., 6 East 44th St., New York.

Fans—Catalog X-1949, on line of fans of all types.—Emerson Electric Mfg. Co., St. Louis.

Here is an example of Signode Bulkbinding of carload shipments. While a mixed shipment of steel drums and barrels, etc. is shown, many other commodities may be also bulkbound.

This Carload Shipping Method PAYS DIVIDENDS

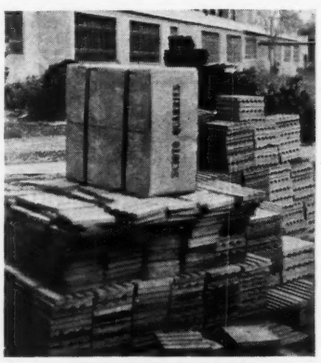
● Shipping costs by ordinary methods, compared with those when Signode Bulkbinding is used, show the latter *sharply less.* The difference is money *not spent* for dunnage and other packing materials, freight bills *decreased,* and damage claims *eliminated.* Every cent not spent is as good as finding the money—a real profit which can be credited to the shipping department. The example pictured above no doubt varies widely from your own product, but Signode Bulkbinding has been applied to over 200 different products—and in every case paid dividends.

Let us send a Signode Packing Engineer to check over your shipping problems with you. Whether they include carload shipments, handling single packages of any size and shape, or both, substantial savings are probable . . . and we're ready to prove it!

SIGNODE STEEL STRAPPING CO.

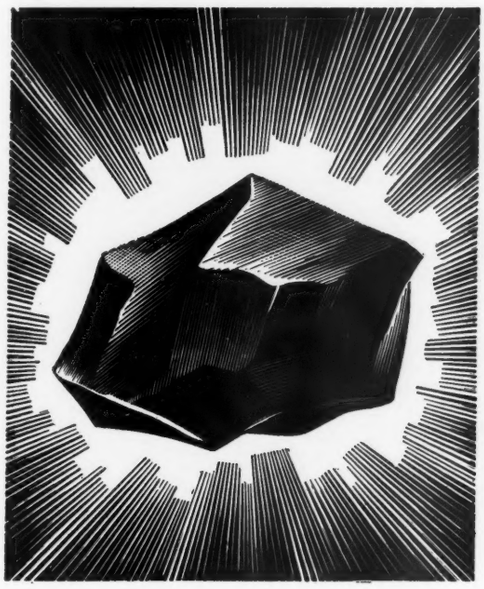
2621 N. Western Ave., Chicago, Ill.

361 Furman Street, Brooklyn, N. Y. — 452 Bryant Street, San Francisco, Calif.



The new Signode Steel-Strapped package used by the Carlyle Tile Co., of Coalgrove, Ohio, which is saving the company 12c per package.

SIGNODE



ASPHALT
Versatile Servant of Industry

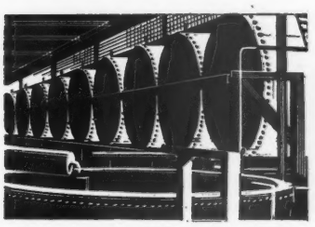
ASPHALT is one of the most versatile substances found in Nature. In the laboratory it is a complex combination of hydrocarbons. In the maintenance, new construction, and manufacturing fields, Asphalt is an elastic, resilient, and resistant substance with an established reputation for adhesion, endurance and protection.

Starting with the basic product, Flintkote, during thirty-six years of cooperation with Industry, has developed specialized Asphalt Products to fill a varied range of requirements.

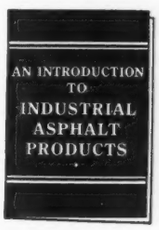
Today the proven utility of Asphalt lies not only in the building of roads, the manufacture of roofing and flooring, the construction and maintenance of industrial plants, public and private buildings, but also finds its place in fields so diversified as to range from tree surgery and metal protection to the manufacture of shoes, automobiles, paper and oatmeal cartons.

New uses, new adaptations of Asphalt in new forms, are being constantly made as this versatile servant of Industry faces the growing opportunities of Tomorrow. In this pioneering, The Flintkote Company leads the way.

No Asphalts available are more scientifically made, nor more perfectly adapted to the practical needs of Industry. And nowhere will you find traditions of fine engineering and scientific control more strictly maintained, or a greater insistence on solid dependability in every functional use of an Asphalt product.



Flintkote is known as "Headquarters for Asphalt Products for Industry" because of standards like these. We invite you to use Flintkote as a yardstick of value. We urge you to review this series of advertisements, for they look forward to the needs of new times and also look back on a long tradition of service and value.



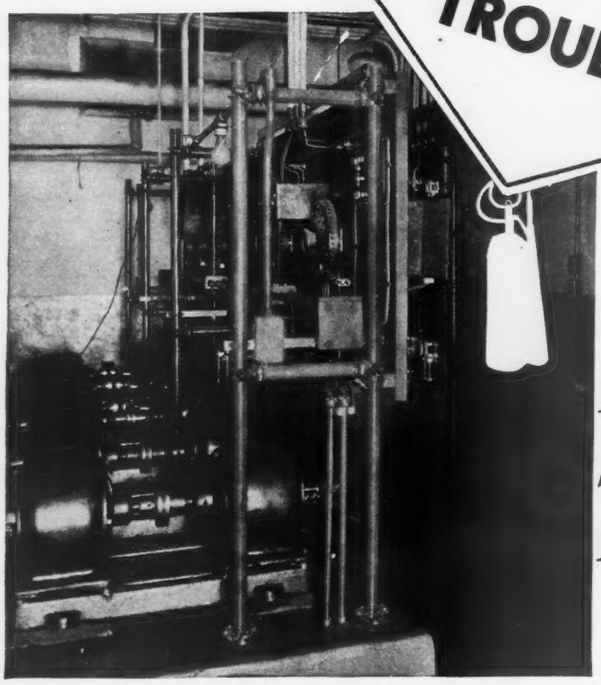
Write for a free copy of this book. The Flintkote Company, 50 W. 50th St., New York, N. Y.

Industrial Asphalts Division

THE FLINTKOTE COMPANY

NEW YORK • CHICAGO • NEW ORLEANS • ATLANTA • BOSTON • DETROIT • LOS ANGELES • ST. LOUIS • WACO

This Empty Space Means SERIOUS TROUBLE



WHEN FIRE STRIKES HERE

Power Room in a communication company's control office

Be ready *with the right extinguisher!*

Here is why experts depend on LUX for any electrical hazard

- LUX carbon-dioxide snow-and-gas is a *non-conductor.*
- The fast-expanding action of LUX drives deep into hidden wiring. It penetrates straight into the heart of the fire — Instantly.
- LUX snow is *clean* and *dry,* will not harm delicate equipment, causes no dangerous fumes.
- LUX will not deteriorate with age nor freeze at any climatic temperature. It is good until used, thereby eliminating maintenance expense.

No other type extinguisher has all these important qualities. LUX is necessary for flammable liquid fires, too. We suggest you get full information on LUX fire protection. Write, on your business letterhead, to

Walter Kidde & Company

32 West Street, Bloomfield, N. J.

for all electrical and flammable liquid fires.

Feed Pumps and Return Units—Bulletin No. 500, on electric boiler feed pumps and condensation return units.—The Deming Co., Salem, Ohio.

Geared Motor Reducer—Folder, on Transitorq geared motor reducer.—New Departure, Division of General Motors Corp., Brisol, Conn.

Heat Transfer Surfaces—Catalog No. 4536, on heat transfer surfaces for air conditioning installations.—Young Radiator Co., Racine, Wis.

Hoisting Equipment—Catalog, on line of hoisting equipment.—Wright Mfg. Division, American Chain & Cable Co., Inc., Bridgeport, Conn..

Knife Grinders—Price List, covering line of automatic knife and saw grinding machines.—Samuel C. Rogers & Co., 191-205 Dutton Ave., Buffalo, N. Y.

Lubrication Equipment—Catalog, covering line of hand guns, power-operated units, fittings, hose, valves, etc.—Alemite Division, Stewart-Warner Corp., 1826 Diversey Parkway, Chicago.

Materials Handling Equipment—Folder No. 321, on equipment for handling barrels, drums, carboys, cartons, etc.—Lewis-Shepard Co., 175 Walnut St., Watertown, Mass.

Meters—Catalog Section 42-210, on types CS-2, CS-5, CS-7, and CS-8 polyphase detachable meters.—Westinghouse Electric & Mfg. Co., East Pittsburgh.

Monel Metal—Booklet, showing applications of Monel in varied fields.—The International Nickel Co., Inc., 67 Wall St., New York.

Motors—Two bulletins: No. 177, on fractional-horsepower motors; No. 182, on squirrel-cage and slip-ring motors.—Wagner Electric Corp., 6400 Plymouth Ave., St. Louis.

Photoelectric Cell — Bulletin GEA-2467, describing light-sensitive cell.—General Electric Co., Schenectady, N. Y.

Pillow Block Seals—Bulletin 517, on auxiliary cap seals for standard duty pillow blocks.—Shafer Bearing Corp., 35 East Wacker Drive, Chicago.

Process Control—Bulletin 479, describing coordinated process control.—The Bristol Co., Waterbury, Conn.

Recorder—Die-Out ND(1), showing Micromax recorder in a folding cardboard model.—Leeds & Northrup Co., 4934 Stenton Ave., Philadelphia.

Reflector—Bulletin, describing reflector for stock bin lighting.—Goodrich Electric Co., North Oakley Ave., Chicago.

Relays—Folder, describing two small relays, one for a.c. and one for d.c.—Guardian Electric Mfg. Co., 1621-27 West Walnut St., Chicago.

Relays—Bulletin Gea-2525, on temperature relays for protecting a.c. machines and transformers.—General Electric Co., Schenectady, N. Y.

Scales—Folder, describing motor truck scales with single link suspension bearing for sustained high sensitivity.—Buffalo Scale Co., Inc., 1198 Niagara St., Buffalo, N. Y.

Sheet Metal—Booklet No. 200, describing machines and tools for sheet metal shops.—Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y.

Sling Chain—Booklet, new edition of "Standard Sling Chain Specifications."—American Chain Division, American Chain & Cable Co., Inc., Bridgeport, Conn.

Spray Painting—Folder, announcing three portable spray painting machines.—Gast Mfg. Co., Bridgman, Mich.

Starters—Two leaflets: one on "De-ion" combination linestarters, one on "De-ion" non-reversing linestarter — Westinghouse Electric & Mfg. Co., East Pittsburgh.

Switch—Bulletin GEA-2369, on Thermo-Tector thermal overload switch for fractional-horsepower motors.—General Electric Co., Schenectady, N. Y.

Switches—Catalog No. 7, on safety starting

Cutting handling costs in two —

Cranes have improved a lot in the past ten years and, for most kinds of work, many of the old-timers now in use are an expense rather than an economy.

On this job, for example, a new Industrial Brownhoist gas crane replaced an old steam machine. The operation consists of unloading aluminum ore from vessel to hopper, whence it is trucked to the plant. With the old crane, the costs including interest, depreciation, and truck hire were between 70 and 80 cents a ton. The new crane, with an Industrial Brownhoist bucket, unloads 110 tons per hour against the old average of 35 to 40 tons and the costs are 40 cents per ton.

If you have not checked your own handling costs recently, it will pay you to do so. You will find that the new Industrial Brownhoists, especially the gasoline and Diesel models, are faster, more economical and much easier to operate than any crane you have ever had. Isn't this worth looking into?

INDUSTRIAL BROWNHOIST CORPORATION
General Offices: Bay City, Michigan
District Offices: NEW YORK • PHILADELPHIA • CLEVELAND • CHICAGO

INDUSTRIAL BROWNHOIST

GOOD WORKING CONDITIONS

DEMAND GOOD LOCKER FACILITIES

• A-S-E Lockers are standard equipment in many plants, located in all parts of the country. Management has long recognized the advantages of furnishing ample lockers for workers and individual equipment.

Employees appreciate the advantages afforded by single or multiple tier A-S-E Lockers. There are many sizes and types, all are designed to withstand hard usage and are fully reinforced at all points where excessive wear or damage may occur. Lockers by A-S-E present an attractive appearance which enables them to be used in the office or in the plant.

The A-S-E engineer is qualified to help you solve your locker problem. He is backed by an organization which for 25 years has been fabricating sturdy, durable lockers for industry. Let him help you economically select and lay out the equipment best suited for your needs. There is no obligation—mail the coupon today.

ALL-STEEL-EQUIP COMPANY

INCORPORATED

501 Kensington Ave., Aurora, Illinois

All-Steel-Equip Company, Inc., 501 Kensington Ave., Aurora, Ill.

We would like to receive more information about A-S-E Lockers

☐ please have an engineer call

☐ please send a copy of your catalog C-30

Name .....

Company .....

Address .....

City ..... State .....

Switches—Catalog Section 7900, on switches for motor and lighting circuits.—The Arrow-Hart & Hegeman Electric Co., Hartford, Conn.

Switchgear—Bulletin 32-165 on cubicle-type switchgear with manually or electrically operated breakers.—Westinghouse Electric & Mfg. Co., East Pittsburgh.

Valves—Catalog No. 36, on operating valves for various types of equipment.—Ross Operating Valve Co., 6488 Epworth Blvd., Detroit.

Vibration Insulators—Catalog Section 7900, on Vibro-Insulators for vibration isolation.—The B. F. Goodrich Co., Akron, Ohio.

Watthour Meters—Catalog Section 42-104, on type OB switchboard watthour meters.—Westinghouse Electric & Mfg. Co., East Pittsburgh.

•

BOOKS

THIS LABOR UNION RACKET

Edward Dean Sullivan. Hillman-Curl, Inc., 66 Fifth Ave., New York. 311 pages. $2.

The author of "Rattling the Cup on Chicago Crime" and "Chicago Surrenders" tells a story of racketeering in organized labor. He alleges use of terror methods in union dealings with workers and employers, and hangs an indictment on the door of union leadership.

WATER TREATMENT AND PURIFICATION

William J. Ryan, M. E. McGraw-Hill Book Co., Inc., 330 West 42d St., New York. 242 pages, index. Illustrated. $2.50.

Summarizes information on water treatment and purification, and describes construction and operation of different types of filtering, softening, and treating equipment. Covers both boiler feed water and potable water.

SALARIES, WAGES AND LABOR RELATIONS

J. O. Hopwood, Director of Employment, Philadelphia Electric Co. The Ronald Press Co., 15 East 26th St., New York. 124 pages, index. $2.50.

Working on the premise that labor is out of the open market, the author outlines and discusses a program for paying just wages. Job evaluation and classification, compensation standards, and administrative procedures and records are broken down and treated in some detail.

FIRST ANNUAL REPORT OF THE SOCIAL SECURITY BOARD

The Social Security Board. United States Government Printing Office, Washington, D. C. 129 pages, index. Tables and maps. 15¢.

For the fiscal year ended June 30, 1936, with supplementary data for the period July 1, 1936—December 15, 1936. Tells of the work of establishing the social security program and reviews progress made. Covers administration of different parts of the act. Appendices show expenditures made and maps show what states have enacted laws approved by the national board.

TENTATIVE CODE OF RECOMMENDED PRACTICES FOR GRINDING, POLISHING, AND BUFFING EQUIPMENT SANITATION

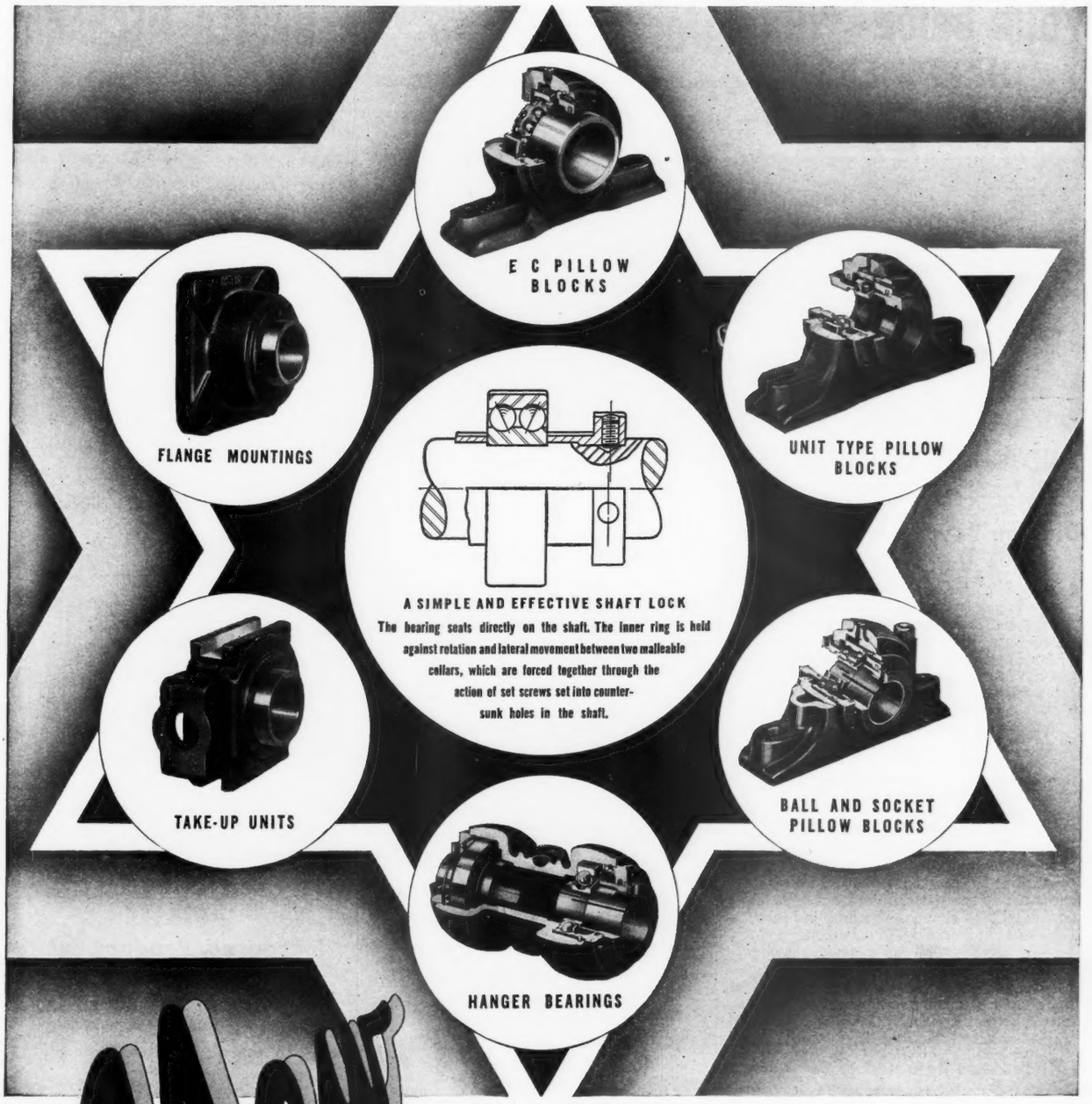
American Foundrymen's Association, Inc., 222 West Adams St., Chicago. 24 pages, 30 figures. $2.

Describes recommended practices for the ventilation of all grinding, buffing, scratch brushing, or abrasive cutoff wheels, and grinding or polishing straps or belts. Series of definitions is followed by sections on applications, design, and testing.

BIG BUSINESS
Its Growth and Its Place

Prepared under the auspices of the Corporation Survey Committee of the Twentieth Century Fund, Inc., Alfred L. Bernheim, Editor. Twentieth Century Fund, Inc., 330 West 42d St., New York. 102 pages. $1.35.

This volume is the first of a series summarizing results of a study of "big business" and aims to put "big business" in its proper place against the whole background of American economic life. Covers rise of


E C PILLOW BLOCKS
FLANGE MOUNTINGS
UNIT TYPE PILLOW BLOCKS
A SIMPLE AND EFFECTIVE SHAFT LOCK
The bearing seats directly on the shaft. The inner ring is held against rotation and lateral movement between two malleable collars, which are forced together through the action of set screws set into countersunk holes in the shaft.
TAKE-UP UNITS
BALL AND SOCKET PILLOW BLOCKS
HANGER BEARINGS

Now . . . AND IN TUNE WITH PRODUCT AND PLANT MODERNIZATION NEEDS

The new CJB Transmission Units not only represent the most complete line offered by any manufacturer, but in addition one which embodies the only noteworthy improvements within the last two decades!

Imagine, for example, the advantages of being able to select from three distinct types of Pillow Blocks any one of nine different capacities for a given shaft size. This unusually wide range of capacities and types (see above) together with many other new and revolutionary features makes the CJB line the logical one to consider in your plant or product modernization programs.

Complete stock now carried by our 28 branches. Write for Catalog and address of nearest branch.

AHLBERG BEARING COMPANY
317 East 29th Street — Chicago, Illinois

CJB PILLOW BLOCKS

WRITE FOR YOUR COPY

Here is one of the most complete (and helpful) catalogs (ever) published on power transmission equipment. Every engineer and maintenance executive should have one on file. Write for your copy today.